

tion is increased from a maximum of 12 degrees per second to a maximum of 33 degrees per second.

(5) **SPRING TRIGGER SWITCH.**—The spring trigger switch is on the front of each handle. The switches are connected to a firing relay which supplies current to the firing solenoids fastened to each gun. Either trigger switch may be depressed to fire both guns.

3. **MAIN TURRET ASSEMBLY.**—The main turret assembly is under the bombardier's station. It has an elevation and azimuth control unit, each with an amplidyne set and motor which mechanically elevates, trains, and fires the guns. There is a hydraulic pressure line and return line from the main hydraulic system for the operation of the hydraulic gun chargers. The bombardier's seat, center column, electrical junction box, azimuth and elevation drive motors, speed reducers, azimuth and elevation gear drives, solenoid valve, aluminum foot casting, lower relay box, guns, turret housing, and ammunition boxes are built and supported on a welded four-armed steel spider assembly which holds the turret to the airplane structure.

a. **CENTER COLUMN.**—The center column supports and rotates the lower turret assembly. It is driven by a double worm gear drive which is mechanically coupled to the azimuth motor. It is supported and guided by two ball type thrust bearings on the top and bottom of the spider assembly.

b. **ELECTRICAL JUNCTION BOX.**—The electrical junction box is between the two forward spider arms with outlets for the controller arm, resistor box, azimuth brake switches and lower relay box.

c. **AZIMUTH AND ELEVATION DRIVE MOTORS.**—The 60-volt, direct current, reversible, shunt wound, elevation and azimuth drive motors are interchangeable. They are coupled to their respective speed reducers, and drive the turret in azimuth and elevation. Power to the motors is supplied by their respective amplidyne generators which are governed by the controller.

d. **SPEED REDUCERS.**—The speed reducer has a cone worm and bronze gear with a ratio of 25-to-1. The two-speed reducers are interchangeable, and are coupled between their respective drive motors and the azimuth or elevation gear.

e. **AZIMUTH AND ELEVATION GEAR DRIVES.**—The azimuth gear drive has its 1/2-HP electric motor connected to the 25-to-1 speed reducer which drives a 50-to-1 steel cone worm gear. The worm gear drives a bronze azimuth gear which is coupled to the center column and rotates at the same speed as the turret. The elevation gear drive has its 1/2-HP electric motor connected to the 25-to-1 speed reducer which drives a 42-to-1 worm gear. The elevation gear drive is attached to the bottom of the center column and the worm gear drives the elevation gear which moves the guns in elevation.

f. **SOLENOID VALVE.**—The solenoid valve controls hydraulic pressure to the gun charger from the airplane's hydraulic system through a swivel gland in the center of the turret. It is operated by pressing the charger button on the controller arm. Do not depress charger button for more than 30 seconds. The chin turret in later B-17G airplanes has manual gun chargers.

g. **ALUMINUM FOOT CASTING.**—The aluminum foot casting is bolted to the lower part of the center column. Its purpose is to support the elevation gears, the lower relay box, and the lower part of the turret housing. The elevation drive gears are housed in an aluminum casting which is attached to the foot casting. The gun arms are hung on the elevation gear shaft which projects from each side of the housing.

h. **LOWER RELAY BOX.**—The lower relay box encloses the electric wires which supply current to the lower movable part of the turret. It contains the firing relay, the elevation dynamic brake relay and the elevation brake micro switches.

i. **GUNS.**—The .50-caliber guns are supported by the gun arms which are mounted on the end of the elevation shafts. The gun arms are machined to provide for the installation of the Edgewater recoil mechanism, and the adjustable rear recoil guide trunnions for adjusting the guns in azimuth and elevation. The gun arms also support part of the case and clip ejection chute.

j. **TURRET HOUSING.**—The turret housing encloses all parts of the main turret assembly that are below the spider except the guns which protrude through the zipper covered slots. The ammunition boxes and the feed chutes are included in the housing. The housing is to minimize wind resistance and to act as a dust cover for the lower parts of the turret. Access doors are conveniently located in the housing.

k. **AMMUNITION BOXES.**—The ammunition boxes are fixed to the aluminum housing on the outboard side of each gun. The boxes have guide chutes and rollers to supply a continuous flow of ammunition to each gun while the guns are moving in azimuth and elevation. The empty cases and belt links are ejected through the bottom of the housing and fall clear of the airplane.

(b) **REMOVAL.**—When removing the turret, disconnect the airplane's batteries before removing the power supply connector from the resistor box. Tape the end of the power line to prevent any damage which might occur if the batteries were re-connected.

#### 1. SIGHT.

a. Disconnect the electrical receptacle on the left hand side of the rheostat.

b. Disconnect the flexible azimuth tachometer shaft from the azimuth gear reduction box.

c. Disconnect the flexible elevation tachometer shaft from the elevation gear reduction box.

d. Remove the four bolts holding the sight mounting plate to the airplane.

## 2. CONTROLLER ARM.

a. Disconnect the electrical conduit from the controller arm at the junction box which is between the two forward supporting arms of the turret.

b. Remove the four bolts holding the hinge bracket to the airplane structure.

## 3. MAIN TURRET ASSEMBLY.

a. Disconnect and cap the hydraulic lines to the turret solenoid valve on turrets with hydraulic gun chargers.

b. Remove the floor coverings between the spider arms.

c. Disconnect all AN connectors on the turret. Remove the cables from the junction box by removing the wire from the terminal strip in the box.

d. Remove the bombardier's seat by removing the bolts that hold the seat to the four spider arms.

e. Remove the turret housing (tub assembly) from the turret support arms by removing the two bolts at the end of each supporting arm and the four screws underneath the tub assembly that are fastened to the lower foot casting. Before the tub can be removed, the guns must be lowered to approximately 15 degrees below the horizontal.

f. Disconnect the azimuth cable by loosening the hex head lock nut at the bottom of the azimuth speed reducer and backing off the hex-headed connector.

g. Disconnect the elevation sight cable by loosening the hex head lock nut and backing off the hex head connector. The elevation sight cable stays with the turret; therefore, care should be taken not to kink or twist the cable during removal.

h. Suspend the turret by the "U" bolts attached to the spider arm.

i. Remove the four bolts at the ends of the spider arms and slowly lower the turret out of the airplane.

j. The turret must be held or stored by suspending it on the four spider arms or by the two "U" bolts attached to the spider arms.

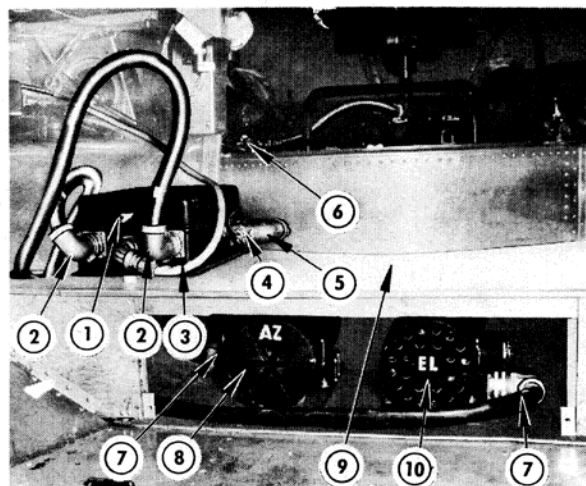
k. Remove the amplidyne generators by disconnecting the electrical lines and removing the two bolts that hold the units to the mounting plates under the navigator's step.

l. Remove the resistor box as follows:

(1) Disconnect the power supply line to the center outlet.

### CAUTION

Care should be taken to prevent the power line from coming in contact with any part of the airplane as it will burn at the slightest contact. Electrical sparks are a serious fire hazard.



1. RESISTOR BOX  
2. AMPLIDYNE OUTLETS  
3. POWER SUPPLY OUTLET  
4. SIGHT RHEOSTAT OUTLET  
5. JUNCTION BOX OUTLET  
6. SOLENOID VALVE  
7. RESISTOR BOX OUTLET  
8. AZIMUTH AMPLIDYNE  
9. NAVIGATOR'S STEP  
10. ELEVATION AMPLIDYNE

Figure 386—Resistor Box and Amplidyne

(2) Disconnect the AN connector of the electrical conduit for the sight rheostat at the resistor box.

(3) Disconnect the electrical conduit from the junction box at the resistor box.

(4) Disconnect the electrical conduit from the amplidynes to the resistor box.

(5) Disconnect the electrical conduit attached to the resistor box from the azimuth drive motor.

(6) Remove the bolts holding the box to the floor or to the vertical support of the navigator's table.

### (c) INSTALLATION.

#### 1. SIGHT.

a. Attach the sight to the mounting plate by the mounting bolts so that it is at the highest position.

b. Connect the flexible azimuth tachometer shaft to the azimuth gear reduction box.

c. Connect the flexible elevation tachometer shaft to the elevation gear reduction box after threading it through the top right and left sides of the sight yoke.

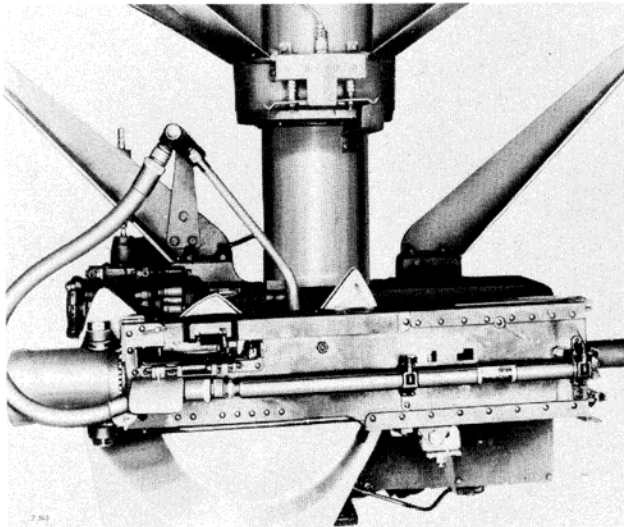
d. Connect the electrical receptacle on the left hand side of the rheostat.

#### 2. CONTROLLER ASSEMBLY.

a. Attach the hinge bracket with the four bolts to the airplane structure on the left side.

b. Connect the electrical conduit from the controller arm to the junction box between the two forward supporting arms of the turret. Attach the numbered wires to the corresponding numbers on the terminal strip.





**Figure 387—Lower Chin Turret Assembly—Left View**

c. Check the two positioning stops on the controller hinge by releasing the locking device on the lower end of the control arm and swinging the con-

troller assembly into the operating position and the stowed position.

### 3. MAIN TURRET ASSEMBLY.

a. Place the packing case under the nose of the airplane so that the terminal box is to the front of the airplane.

b. Attach the hoisting mechanism to the two "U" bolts located on the two supporting arms.

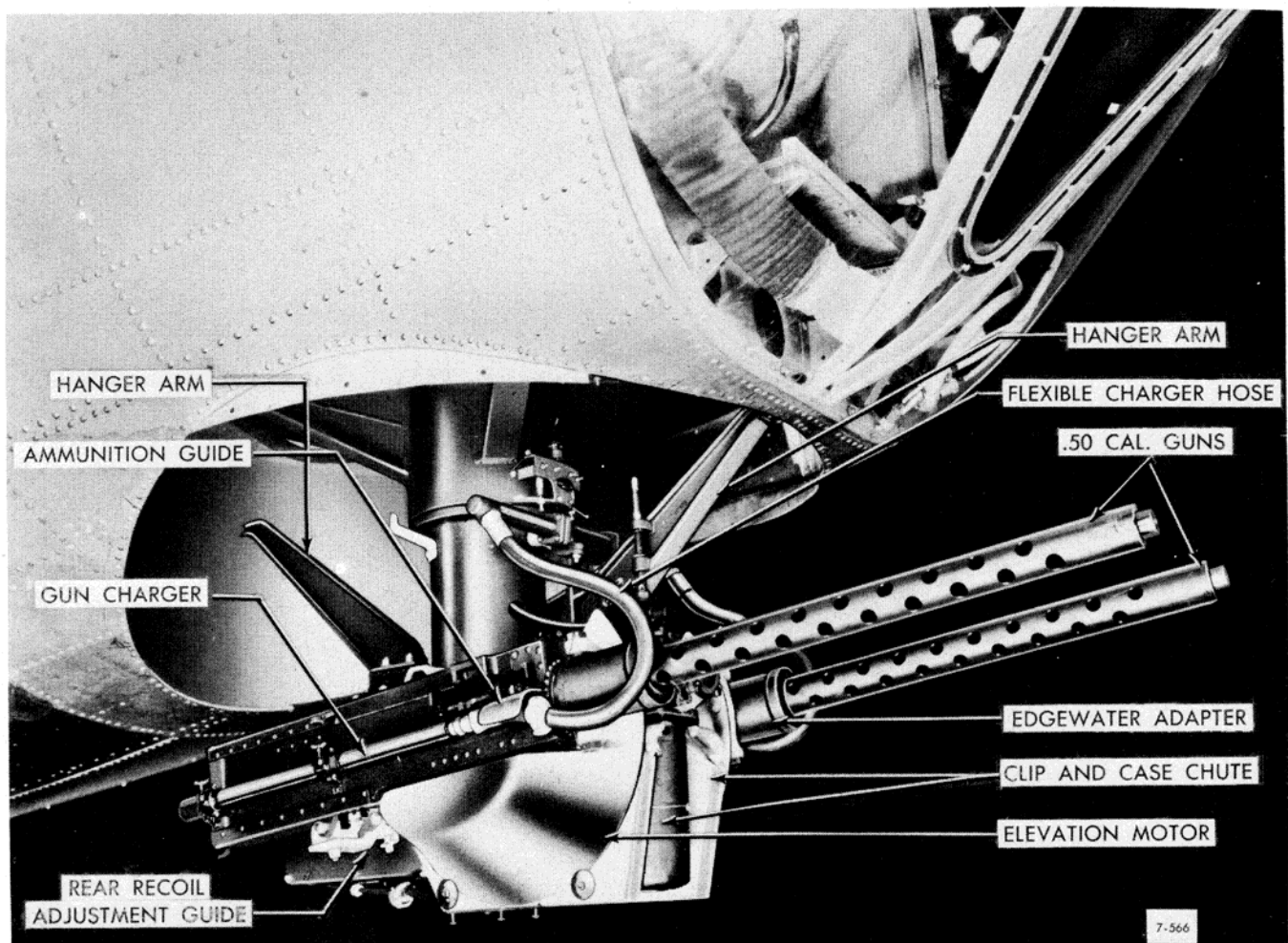
c. Remove the four bolts or screws holding the supporting arms to the iron frame of the packing case.

d. Hoist the turret a few inches out of the packing case.

e. Remove the tub assembly by removing the two bolts on each tub supporting arm and the four screws on the underside of the tub.

f. Raise the turret into the well of the airplane. Do not bump parts of the turret and do not suspend it from any point except from the ends of the four spider arms or from the two lift U-bolts attached to the spider arms.

g. Carefully position the turret against the



**Figure 388—Chin Turret (Housing Removed)**



bottom of the mounting well supports and align the bolt holes.

h. Bolt the spider arms to the mounting well frame. The junction box must be between the two forward spider arms. Shim, if necessary, to make the spider arms flush with the mounting points on the well.

i. Do not install the tub assembly until the guns and accessories are installed.

j. Install the guns as follows:

(1) Select two M-2 .50-caliber guns, one for each side.

(2) Remove the rigid forward gun mounting adapter bracket by pulling the lock pins and unscrewing the brackets.

(3) Install an Edgewater recoil mechanism on each gun by slipping the mechanism over the end of the barrel and screwing it into place against the threaded shoulders on the guns.

(4) Lock the recoil mechanism in place with the lock pin on the bottom of the gun.

(5) Two long springs, one short spring, and a sheet metal guide are attached to the feed pawl on the outside of each gun.

(6) Auxiliary clip chutes are installed on the inside of each gun on the opposite side of the shell guides. The clips are fastened to the guns by pins which are inserted through the hole in the bottom of the chute. The long side of the chute is to the front of the guns and the openings are down.

(7) Fasten two electric firing solenoids to the inside of each gun in the slots to the rear of the guns. The solenoid has a mounting pad with a beveled shoulder and a sliding mounting bolt with a square head beveled on one side, which is used to hold the solenoid to the side of the gun. Attach the firing solenoids to the guns by inserting the mounting pads of the solenoids into the slots on the guns so the beveled edge of the pad catches behind the side plate of the guns. Move the mounting stud to the other side of the gun slot so the beveled edge catches behind the side plate of the gun and then tighten in place. Fasten the solenoid cables to the gun arms with clips and screws. Time the solenoids so that the guns will fire simultaneously.

(8) Attach two Bendix .50-caliber hydraulic gun chargers to the outside of each gun. The chargers are held on by quick locking brackets screwed to the guns so that no alteration of parts is necessary. (Later B-17G turrets have manually charged guns.)

(9) After the gun equipment is installed, the guns can be attached to the gun arms.

(10) Remove the recoil adjustment guides from the gun arms by backing off the elastic stop nuts. Insert the recoil adjusting guides between the rear mounting ears on the under side of the guns. Insert the rear mounting bolts through the recoil guides and into the ears on the gun. It is important that the bolts

be inserted from the inside (the side on which the firing solenoid is mounted). Thread the locknuts over the ends of the rear mounting bolts. Nuts must be on the same side as the charger. Place the left gun against the outside of the left gun arm and the right gun against the right gun arm, with the holes in the yoke brakes aligning with the holes in the recoil mechanism.

(11) Locate the rear of the guns so the recoil guides are properly aligned with the rear mounting brackets. Anchor the guns by threading elastic stop nuts over threaded portion of the recoil guides which extend through rear mounting bracket and adjusting plate.

(12) Fasten the guns in place at the front of the gun arms by inserting the yoke attaching studs through the holes in the top and bottom of each yoke arm and tightening into the threads in the Edgewater recoil mechanisms. If there is any looseness between the recoil mechanisms and yoke, place shims on the upper part of the recoil between the recoil and the yoke mounting arms. Lock wire studs.

(13) Connect the hydraulic lines which extend from the manifold to the front of the chargers.

(14) Connect the conduit assemblies which extend from the lower relay box to the chargers.

k. Connect the hydraulic lines to the turret solenoid valve.

l. Move the guns 10 to 15 degrees below the horizontal. Place the housing assembly into position against the bottom of the two hanger arms by putting the guns through the holes in the zippers. Bolt the housing assembly into position. Fasten the ends of the three ammunition guide springs, one to the ammunition can, and two to the holes in the movable housing.

m. Install the amplidyne generators as follows:

(1) Install the azimuth and elevation amplidynes under the navigator's step, the azimuth on the left and the elevation on the right of the airplane centerline, with the AN outlets facing outboard.

(2) Fasten the amplidynes to the mounting plates which are fastened in front by two bolts.

(3) Connect the electrical lines.

n. Install the resistor box as follows:

(1) The resistor box is bolted to the floor of the navigator's step on the left side of the airplane. It is mounted with the amplidyne outlets facing aft; the azimuth outlet to the left, and the elevation on the right. Some airplanes have the resistor box mounted on the vertical forward support of the navigator's table.

(2) The flexible conduit attached to the resistor box is connected to the azimuth drive motor.

(3) Connect the amplidynes to the AN amplidyne outlet on the resistor box with the furnished flexible conduit. Be sure that the azimuth amplidyne is connected to the AN azimuth outlet, and the elevation amplidyne to the AN elevation outlet.



(4) Connect the flexible conduit from the junction box to the large AN outlet on the bottom of the resistor box.

(5) Connect the flexible conduit from the sight rheostat to the small AN outlet on the bottom of the resistor box.

(6) Connect the 24-volt power supply to the center outlet on the outboard side of the resistor box.

### CAUTION

Do not let the power line come in contact with any part of the airplane as it will burn at the slightest contact. Electric sparks are a serious fire hazard.

o. The seat is bolted at four points on the turret spider arms.

p. Harmonize the guns and the sight. (See Boresighting, paragraph (9)).

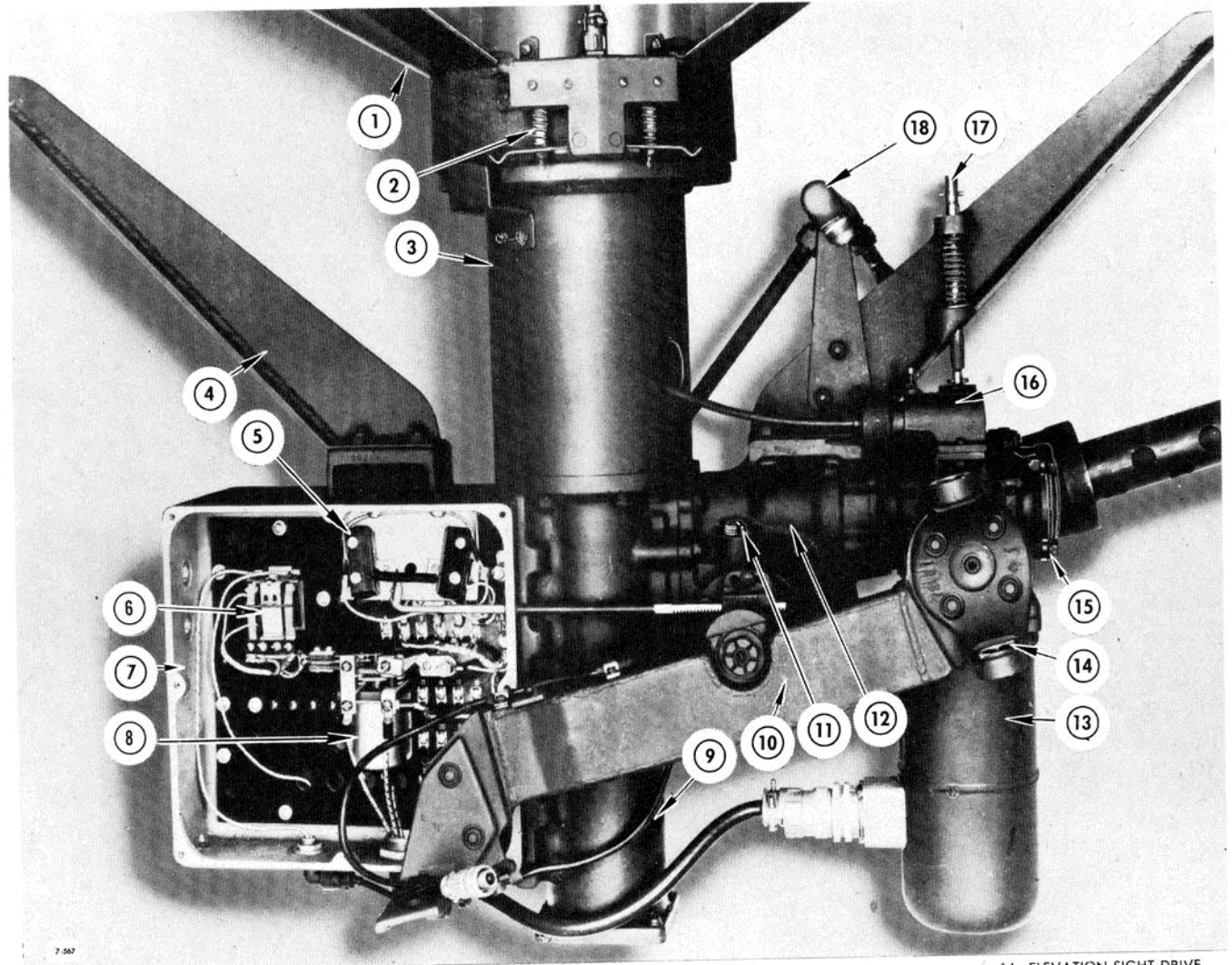
### (d) MINOR REPAIRS AND REPLACEMENTS.

1. Repairs and replacements to guns and mounts must be in accordance with ordnance and armament instructions.

2. The chin turret sight backlash can be taken out by loosening the screws of either azimuth or elevation pinion gear box, shifting the assembly in the proper direction and securing the screws.

3. The electrical neutral or width of the "dead spot" of the controller can be adjusted by the small potentiometers attached to each split potentiometer to suit the needs of the operator.

4. Adjust the potentiometer location for mini-



1. SPIDER ARMS
2. AZIMUTH LIMIT SWITCHES
3. CENTER COLUMN
4. SUPPORTING ARM
5. ELEVATION LIMIT SWITCHES

6. FIRING RELAY
7. LOWER RELAY BOX
8. ELEVATION DYNAMIC BRAKE
9. FOOT CASTING
10. GUN ARM

11. GREASE INSPECTION HOLE
12. ELEVATION GEAR HOUSING
13. ELEVATION MOTOR
14. FRONT MOUNTING TRUNNIONS
15. ELEVATION SPEED REDUCER

16. ELEVATION SIGHT DRIVE
17. ELEVATION MANUAL CRANK EXTENSION
18. HYDRAULIC GUN CHARGER OUTLETS

Figure 389—Lower Chin Turret Assembly—Right View



imum backlash in gearing, and adjust the contacts for firm contact with the resistance wire.

5. The azimuth brakes can be adjusted by backing off the lock nut and turning the fillister screw located on the fore part of the spider assembly underneath the junction box in the proper direction and then locking the lock nut. The elevation dynamic brake limits can be adjusted by loosening the screws which hold the micro switches located in the lower relay box, and retightening after the correct adjustment has been determined.

6. All relay and solenoid contacts in the resistor box and the lower relay box should be dressed when pitted, corroded, or when there are signs of sticking. They should be adjusted to have a wiping action of at least 1/64 inch.

7. If the commutator needs cleaning, sand lightly with No. 0000 sandpaper. Blow out all dust after sanding. Never use emery cloth for this purpose. Generally, the commutator must be refinished and carefully undercut after wearing out two sets of brushes. Do not lubricate commutators in any manner. Brushes should be sanded to fit commutator.

8. If chafing or rust is found on the ammunition cans, clean them, and apply a coat of paint.

### (3) TOP TURRET

(a) GENERAL.—The top turret installation is in the rear of the pilots' compartment. It has two .50 caliber machine guns. The Sperry K-3 sight computes the lead and ballistics when the gunner "tracks" the target. The turret can be turned in azimuth through 360 degrees (6400 mils) and the guns raised from 0 to 85 degrees.

1. The turret and guns are operated by a hydraulic unit within the turret. The unit has an azimuth system and an elevation system. One electric motor operates both systems. Each system has a constant speed variable displacement hydraulic pump, a variable speed, fixed displacement hydraulic motor, and a control and replenishing pump.

2. The turret is rotated by turning the hand control unit. This unit runs a booster piston which, through a linkage, displaces a movable yoke to one side or the other. If the pump is turning up about 4000 RPM and the yoke is in its normal position, the pump rotation does not affect the position of the pistons in the cylinders. If the yoke is displaced in either direction, the piston will move in and out as the pump rotates off center, and will force the hydraulic fluid from the cylinders to the hydraulic motor. The hydraulic motor spins the end shaft. This shaft is geared to the azimuth mechanism of the turret and the elevation mechanism of the guns. If the hand control unit is turned to the left, the turret rotates to the left. If the handles are pushed down, the guns will rise.

3. The control and replenishing pump is also driven by the constant speed electric motor. Replenishing valves let in more hydraulic fluid if the pressure

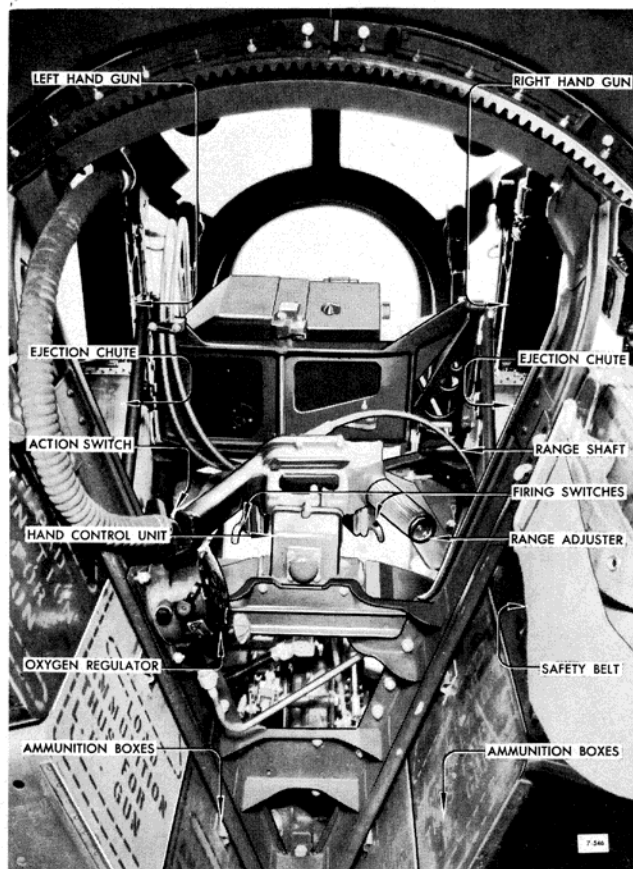


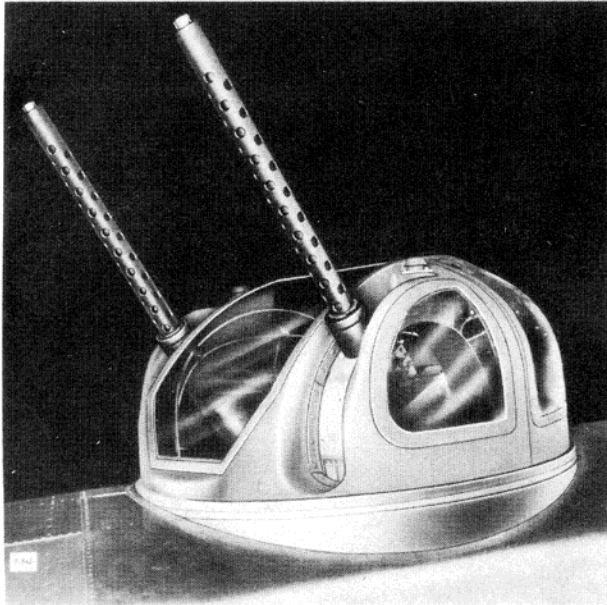
Figure 390—Top Turret Interior—Front View

falls below a certain limit. Relief valves reduce the possibility of damage to the system from too much pressure. The range adjustment knob is on the control unit. There is a firing switch on each hand grip, and either switch will fire both guns. When you release the "dead man switch" on the left hand grip, the circuit opens and cuts the power for both the guns and the turret. The range mechanism gear box on top of the control unit is connected by a flexible shaft to the range input of the computing sight. The control unit is connected to the hydraulic unit by shafts and gear trains through the fire cut-off and elevation limit unit. This unit stops the gun fire when the guns are pointed at the airplane and shuts off the hydraulic power when the guns reach the elevation limit.

4. Switches, fuses and the power relay for electrical control are housed in a metal box. There are power interconnection terminals for various units in the turret, and telephone connections for the interphone. Two single pole switches in the box control the firing solenoids of the guns. They can be set so the guns may be fired individually or together. The telephone and microphone jacks are of the open circuit type.

5. All connections from the turret to the airplane's power supply and inter-connecting circuits are made through a terminal box. This box is next to the





**Figure 391—Top Turret Installation**

thrust bearing mounting flange at the base of the turret.

6. The collector ring assembly lets the turret rotate continuously without twisting or straining the electrical wiring between the turret and the airplane. This assembly has a fixed section which holds the collector rings and is fastened to the airplane structure at the base of the turret. A revolving section containing brushes rotates with the turret.

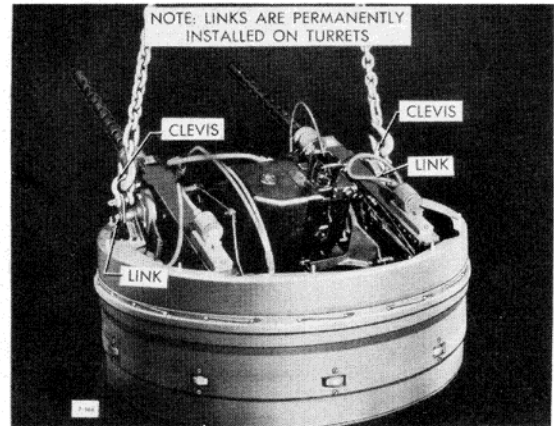
**(b) REMOVAL.**

1. Disconnect the gun slot covers at the studs on the turret flange, and remove the covers. Rotate the turret until the zero azimuth on the turret ring and the stationary ring gear coincide. If the marks on the teeth of the drive pinion and the ring gear are not easily visible, improve the marks in order to facilitate reassembly. Attach the hoist sling at the lugs on the A-frame and remove the bolts from the thrust bearing mounting flange at the bottom of the turret support. Hoist the entire assembly straight up and secure the drive pinion against turning. Retain the shims at the support fitting in the airplane as originally installed, to facilitate alignment when replacing the turret.

2. To remove the ring gear, disconnect at the mounting bolts and remove two opposite flanges by removing the 10 retaining bolts. Remove the gear from the structure and retain the shims as originally installed. With the flanges removed, the gear may be hoisted through the opening in the top of the fuselage.

**(c) INSTALLATION.**

1. If a new or repaired turret is to be installed, the turret must be rotated with respect to the azimuth ring gear before the ring gear is removed from the assembly stand, so that the zero azimuth mark on the outside of the ring casting coincides with the zero



**Figure 392—Hoisting Upper Turret**

azimuth mark on the ring gear. Also, the position of the drive pinion with respect to the ring gear must be indexed in this position.

**CAUTION**

Secure the drive pinion against turning while it is separated from the ring gear, as it must be remeshed in exactly the same position in order to hold the fire cut-off setting. In all cases check the fire cut-off setting after installation of a turret. In some instances it may be more convenient to disregard position of drive pinion and completely readjust the fire cut-off mechanism after turret installation.

2. Remove two opposite flanges on the ring gear and insert the ring gear through the hole in the fuselage. Replace the flanges and mount the gear in the supporting structure, shimming as required to level the gear. Install the ring gear so that the zero azimuth point, marked "Ag-O," coincides with the mark on the supporting structure. This mark should be on the center line of the airplane at the forward edge of the support within plus or minus one degree.

3. Remove the gun slot covers and attach a hoist sling at the A-frames. Lower the turret carefully through the ring gear into the fuselage, and rotate the turret so that the zero mark on the turret ring coincides with the zero mark on the ring gear, taking care to mesh the drive pinion exactly as marked without rotating the pinion. Add to, or remove from, the original shims between the floor fitting and the thrust bearing mounting flange until the lower surface of the azimuth drive pinion is between 1/64 inch above and 1/16 inch below the ring gear. While shimming at the thrust bearing, care should be taken to centralize the turret. This may be accomplished by rotating the turret and checking the position of the pinion at intervals around the circumference. At the same time check for leveling of the turret by observing that the vertical position of the pinion, with respect to the gear, is maintained. When satisfactorily aligned, with the weight of the turret resting on the shims, bolt the mounting flange through the shims to the floor fitting.



(d) MINOR REPAIRS AND REPLACEMENTS.

1. Repairs and replacements to guns and mounts must be in accordance with ordnance and armament instructions.

2. Over a period of time, airplane structure may yield to the extent of permitting the turret drive pinion to drop below the proper position with respect to the ring gear. At the top gun turret, the lower surface of the drive pinion should be between 1/64 inch above and 1/64 inch below the lower surface of the ring gear. Add shims at the top turret support in order to regain the proper position. Remove the gun slot covers and use hoisting equipment to accomplish this work. Be careful to maintain the alignment of the turrets during the operation.

(4) RADIO COMPARTMENT GUN.

(a) GENERAL.—There is one .50-caliber ring-mounted gun in the upper part of the radio compartment. To fire, remove the window and move the gun aft on the two slide tracks. A flexible feed and a 250-round ammunition box, on the right hand side of bulkhead 6, feed the gun.

(b) REMOVAL.—Remove the gun from the yoke by loosening the retainer nut from around the gun barrel. Then remove the trunnion bolt, the spring-loaded compression bolt, and four brace bolts on the gun yoke bracket. Pull the gun barrel out of the yoke bearing. The yoke assembly may be removed by unbolting the stop at the forward end of the left carriage

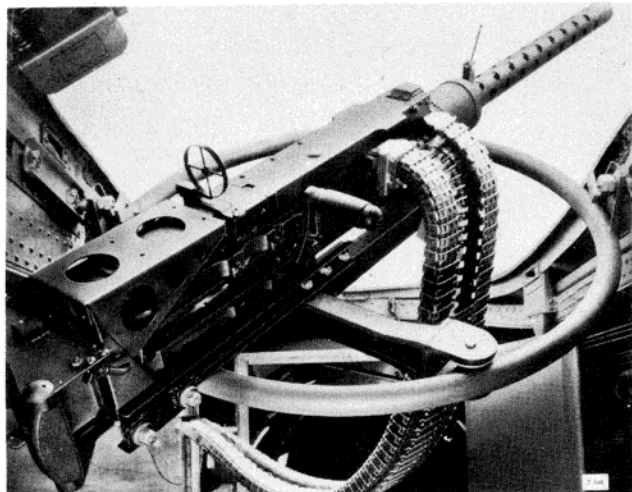


Figure 394—Radio Compartment Gun (Ammunition Chute Is Inverted at Arrow)

track. Push the yoke assembly forward until the carriage falls free of the track, tilt the yoke and pull out.

(c) INSTALLATION.—To install the radio compartment guns, reverse removal procedure.

(d) MINOR REPAIRS AND REPLACEMENTS.—Repairs and replacements to guns and mounts must be in accordance with ordnance and armament instructions.

(5) BOTTOM TURRET.

(a) GENERAL.—The bottom turret is on the underside of the fuselage aft of station 6. It is supported by a centralized column with a self-aligning bearing, which goes to a supporting beam on the upper portion of the fuselage. A fixed circular ring gear on the lower part of the fuselage meshes with the azimuth pinion gear of the turret so that when the pinion gear is rotated, the turret turns in azimuth. The elevation pinion gear

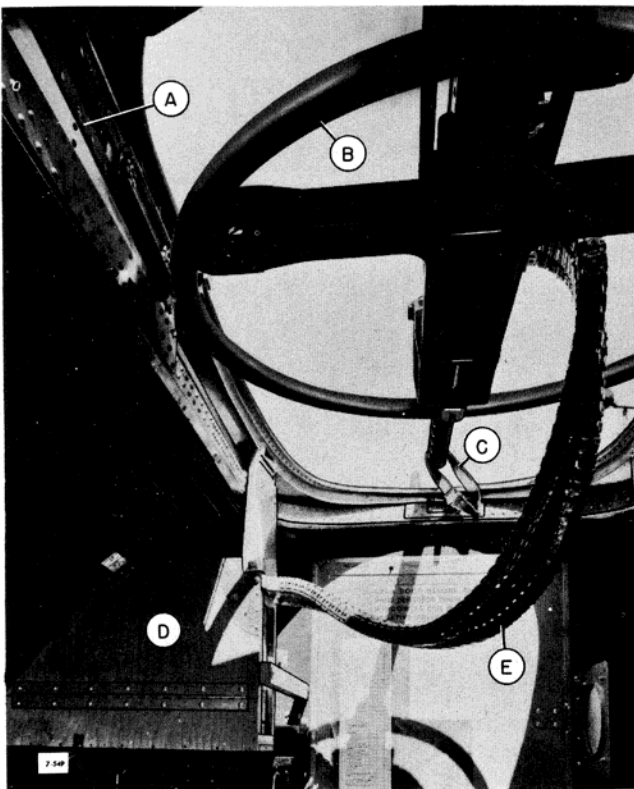


Figure 393—Radio Compartment Gun—Looking Aft

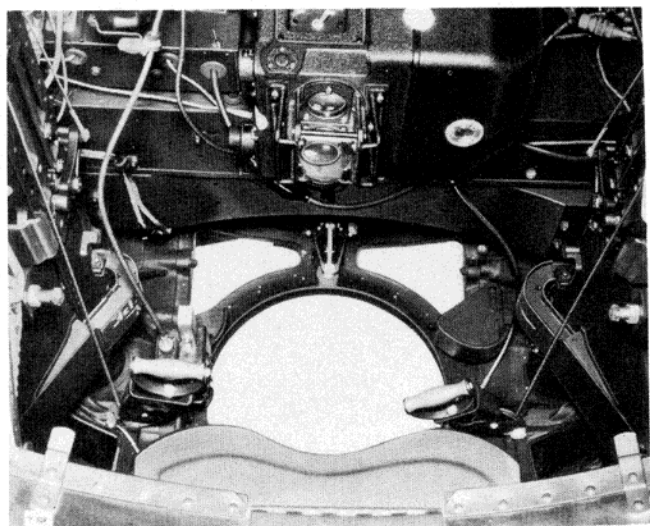


Figure 395—Bottom Turret—Interior View



meshes with an elevation rack and drives the inner portion of the turret. The drive mechanisms and limit stops let the turret move 360 degrees (6400 mils) in azimuth and from 0 to 90 degrees (-1600 mils) downward.

1. The K-4 computing sight is between the two guns and in front of the gunner's seat. Controlled power drives give tracing rates from 0 to 45 degrees per second in azimuth and 0 to 30 degrees per second in elevation.

2. The hydraulic unit drives the turret in azimuth and elevation. This unit has a breather tank for adding fluid to the system.

3. The gunner's hand controls and elevation limit stop are in a unit which regulates the output of the azimuth or elevation to control the turret motion in these planes. When the hand grips are released, they return to their center position. Gun firing switches in parallel are at the end of each hand grip. Either switch fires the guns. The gunner can operate the range control with his foot. Foot pressure on the support increases the range up to 1000 yards.

4. The switch box forward and left of the gunner controls the distribution of the electric power to the various units in the turret. The gunner can operate the push-to-talk switch with his right foot.

5. A fire cut-off cam and switch stop gun fire

when the guns point at any part of the airplane or its accessories. The cam is a metal ring on the flange of the azimuth ring gear. It is cut so that it operates a switch pin lever whenever the guns are pointed at the airplane. The switch pin sticks out through the turret wall and is normally extended to its full length. This position of the pin closes the switch and the firing solenoids can be used. If the turret is moved so that the guns point at any part of the airplane, the cam surface pushes the pin in and the gun firing circuit is opened.

6. Each gun has an ammunition box with a chute for feeding the guns and leading away the links and fired shells.

#### (b) REMOVAL.

1. In order to provide clearance for removal of the turret assembly, the rear portion of the fuselage must be raised until the center line of the airplane is approximately level. Position the turret so that the guns are directed rearward approximately 45 degrees to the left and 45 degrees downward from the center line of the airplane. This is necessary to facilitate removal of the ring gear without interference from surrounding structure. Place a supporting cradle beneath the turret, and raise slightly to relieve the turret weight from the supporting column.

#### CAUTION

It is very important that electrical power be turned off before attempting to disconnect the power leads to the turrets. A fuse is not provided in the power line, and accidental grounding of the contacts may result in injury to the personnel and structural damage.

2. Disconnect the electrical wiring at the upper support bearing, and detach all ring gear mounts from the supporting structure. Remove bolts from the top fitting and retrieve the shims, retaining them as originally installed to facilitate reassembly adjustments. Disconnect the lower supports from the turret and remove the entire supporting truss from the airplane. Elevate the turret approximately six inches, until the turret flange clears the surrounding structure, and slip the ring gear (with fire cut-off cam attached) from the assembly. The entire turret assembly may now be lowered from the fuselage.

#### (c) INSTALLATION.

1. The three subassemblies of the turret, prior to installation, are: the ball, complete with driving mechanism and armament; the supporting truss with rotor bearing; and the ring gear with the fire cut-off cam attached. To facilitate installation, the attitude of the airplane and the relative position of the turret should be the same as described in the removal procedure. Support the ball on a cradle and raise vertically into the turret cavity. Place the ring gear around the turret in its approximate position and continue to raise the ball until the turret flange is approximately six inches above its normal position, or as far as possible

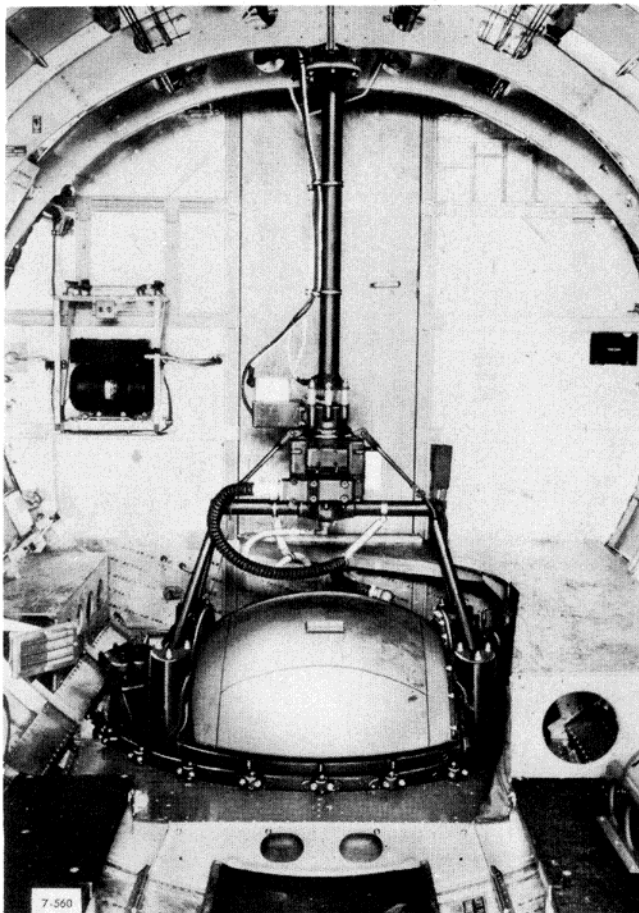


Figure 396—Bottom Turret—Inside Airplane



without interference from surrounding structure. At this position the ring gear (and the attached fire cut-off cam) is adjusted in place over the guide wheels. The entire assembly is then lowered until the turret, the ring gear, and the fire cut-off cam are moved to their final positions. The ball, meanwhile, must be supported in such a manner that movement in any direction is possible in order to facilitate these adjustments.

2. With ring gear in place, but not secured, install supporting truss with each lower connection over its respective boss on the turret casting, and the upper bearing aligned with its support bracket in the top of the fuselage. The connection of the electrical conduit, from supporting truss to ball casting, must be on the same side of the airplane center line. Attach the lower end of the support truss to the turret and check lock nuts for tight fit. Place shims in the upper support connection exactly in the same position as the original installation. These shims should provide 1/8-inch clearance between the gun bosses and lower surface of the fuselage. If it is impossible to replace original shims, this clearance must be checked carefully.

3. To complete the installation, bolt the ring gear to the supporting structure, check the position of drive pinion relative to ring gear. The upper surface of drive pinion should be between 3/16 and 1/8 inch above the upper surface of ring gear. Entire ring gear assembly may be raised or lowered to bring this dimension within the prescribed limits. Connect electrical leads to receptacles and rotate the turret assembly, with power off, through 360 degrees; also check for clearance of gun bosses and for free operation of drive pinion.

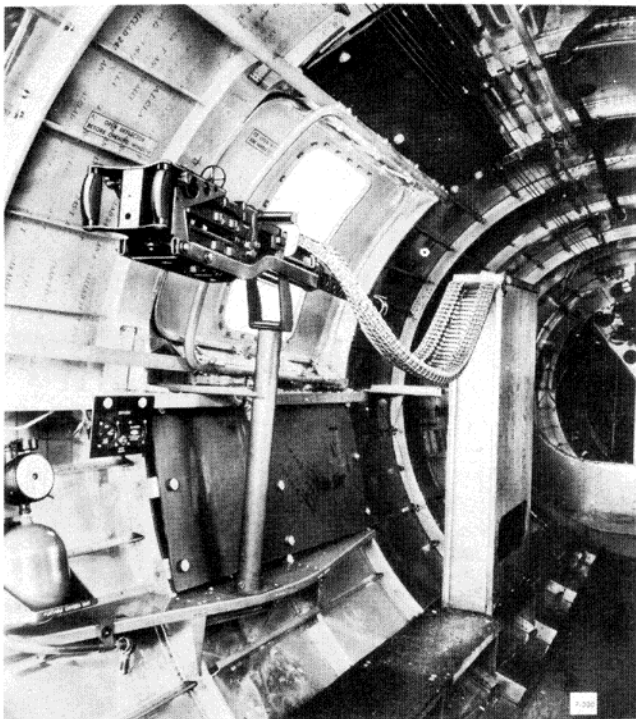


Figure 397—Side Gunner's Station

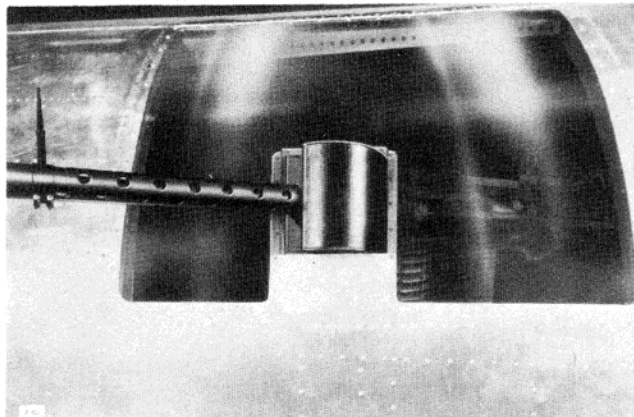


Figure 398—Staggered Side Gun—Exterior View

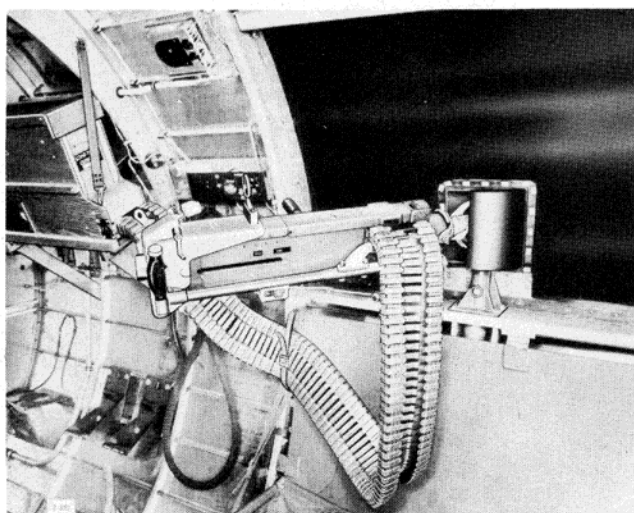


Figure 399—Staggered Side Gun—Interior View

(d) MINOR REPAIRS AND REPLACEMENTS.

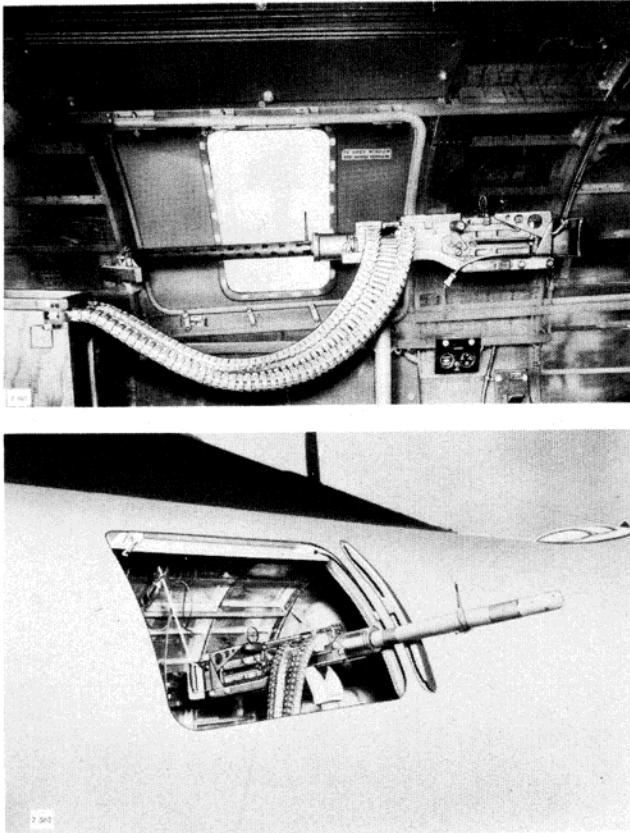
1. Repairs and replacements to guns and mounts must be in accordance with ordnance and armament instructions.

2. Over a period of time, airplane structure may yield to the extent of permitting the turret drive pinion to drop below the proper position with respect to the ring gear. At the bottom gun turret, the upper surface of the drive pinion should be between 3/16 and 1/8 inch above the upper surface of the ring gear. Remove shims at the bottom turret support in order to regain the proper position. Remove the gun slot covers and use hoisting equipment to accomplish this work. Be careful to maintain the alignment of the turrets during the operation.

(6) SIDE GUNS.

(a) GENERAL.—There are two .50-caliber flexible guns, one on either side in the rear fuselage compartment. They are mounted on yoke assemblies and may be easily removed as a unit. Individual 600-round ammunition boxes and flexible feeds are placed aft of the guns. Later airplanes have staggered side guns. The

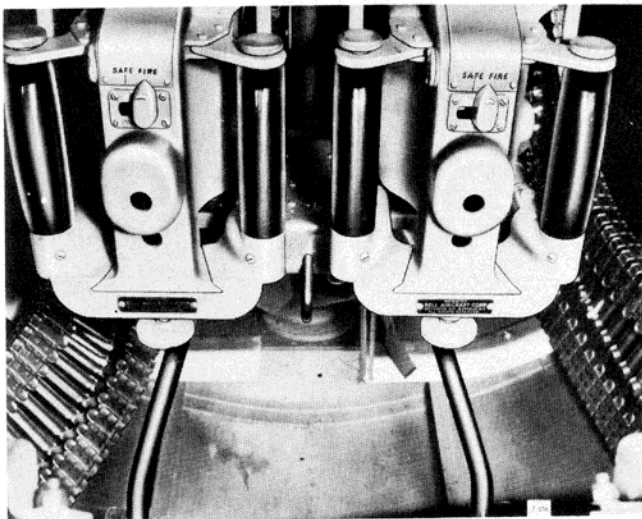




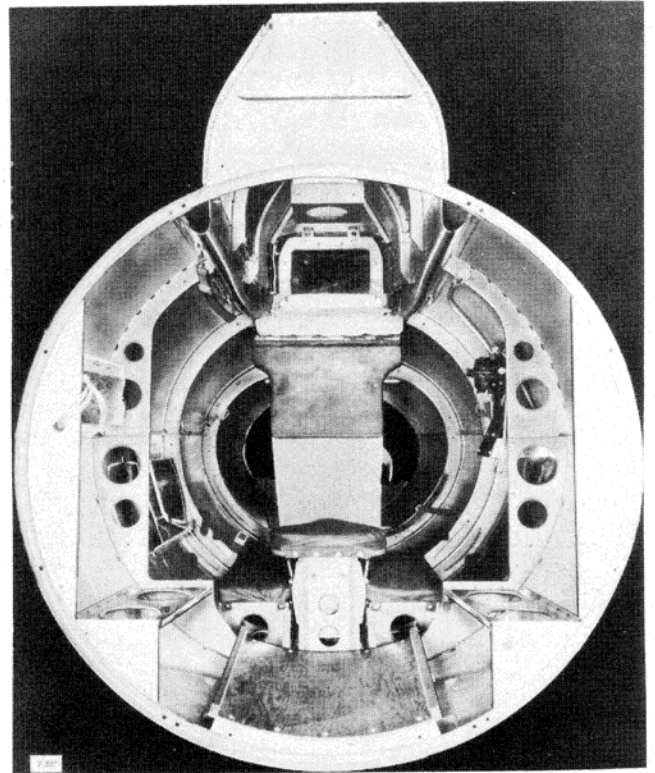
**Figure 400—Side Gun Views**

left gun is in the same position and the right gun is moved forward to give the gunners more room. The guns are always in the combat position and are mounted in K-6 mounts which are in the permanently closed windows.

(b) REMOVAL.—Disconnect the web strap securing the gun barrel, pull out the spring-loaded retaining bolt, and lift the gun from the mount. The mount itself may be removed by loosening the bolts at each end.



**Figure 401—Tail Gun Stowage Lock**



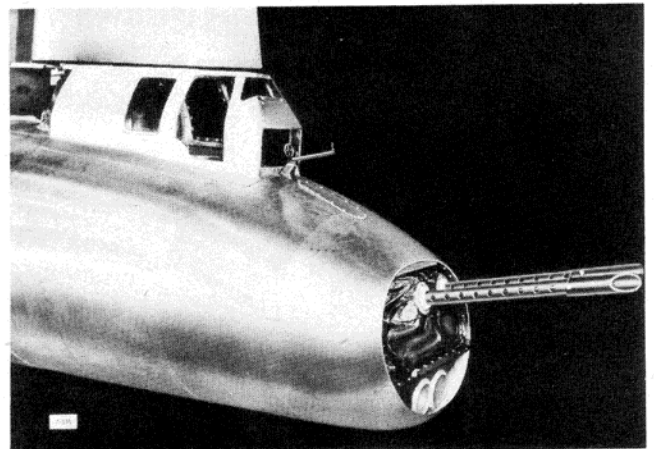
**Figure 402—Tail Gun Section—Looking Aft**

(c) INSTALLATION.—To install the side guns, reverse removal procedure.

(d) MINOR REPAIRS AND REPLACEMENTS.—Repairs and replacements to guns and mounts must be in accordance with ordnance and armament instructions.

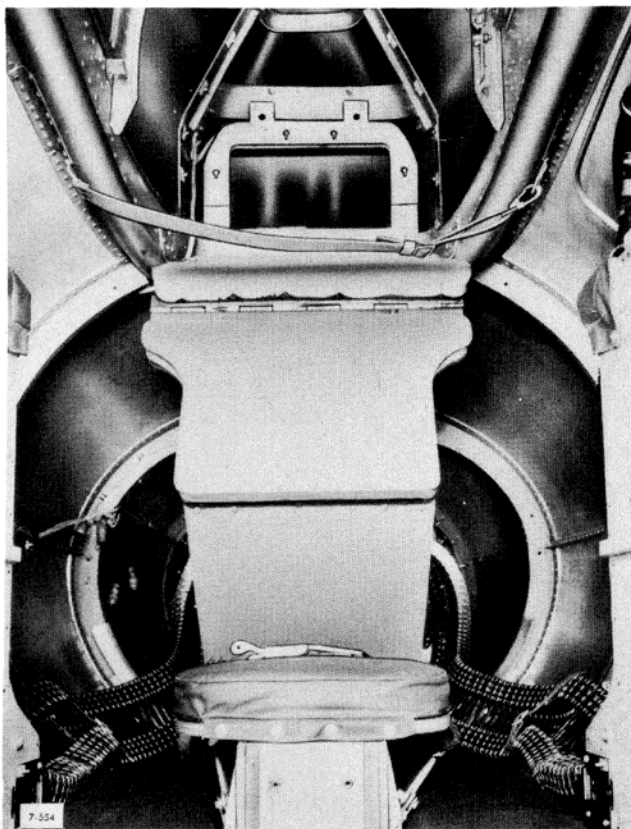
#### (7) TAIL GUNS.

(a) GENERAL.—Twin .50-caliber flexible guns are installed in the tail. The tail gun enclosure is accessible from within the airplane, and is at the extreme rear end of the fuselage, beneath the rudder. An adjustable seat and kneeling pads are provided with a 500-round ammunition box at each side. A remote sight is provided in the installation to permit the gunner to keep



**Figure 403—Tail Gun Section—Exterior**





**Figure 404—Tail Gun Flexible Ammunition Feed—Looking Aft**

upright while in action. The tail gun is normally in a locked position. This lock consists of a spring-loaded plunger which locks under a "U"-shaped rod held in a channel on the gun underframe. The gun is released for action by the gunner drawing the plunger toward himself and at the same time elevating the gun handles. The rod freed from the channel of the gun will fall aft. To stow the gun, the rod is lifted from the floor to a vertical position, the gun is lowered so the rod fits into the channel and the plunger is released locking the rod in the gun channel.

**Note**

If possible, the ammunition selected for the power turrets should be assembled with type M-2 extra-flexible links.

**(b) REMOVAL.**

1. Disconnect the ammunition boxes at four points on each support and remove them from the enclosure. Strap the hinged armor plate in the upward position and remove both guns. Remove the access door on the top of the enclosure aft of the sight, and disconnect the cables at the turnbuckles. Remove the taper pin from the bearing collar and post at the base of the sight, inside the enclosure, and withdraw the sight from the top bearing. Release the two cables at the top of the post, and remove the four bolts in each bearing flange at the top and bottom of the gun support post.

Tip the axis of the post to a horizontal position, and remove the assembly in the forward direction.

2. The elevation cables and rocker may be removed from the post by withdrawing the operating pin at the right side of the post.

**(c) INSTALLATION.**

1. To install the tail gun mount and remote sight, first attach the elevation cables to the rocker and install the rocker in the post. Install the post in the enclosure with the protruding cables at the top. Install the type E-5 adapters in the yokes, and assemble the operating mechanism between the right adapter and the rocker operating pin. Attach the azimuth cables at the top of the post, and thread the four cables through the pulleys and up to the access opening at the top of the enclosure. Thread the elevation cables through the top of the enclosure, and install the sight in the bearing. Insert taper pin through bearing collar and post.

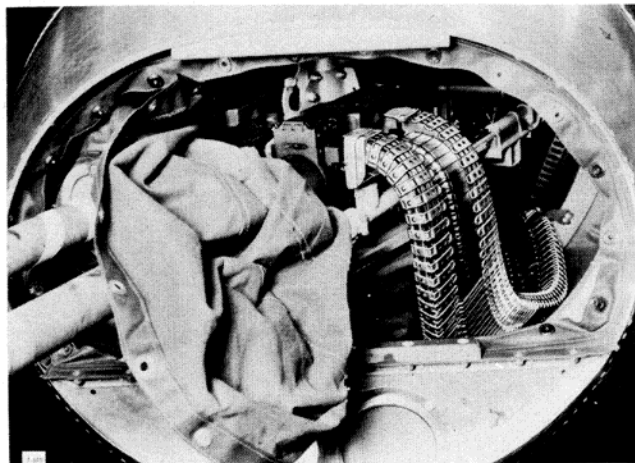
2. Attach the azimuth cables at bottom pulley and thread the four cables through access opening in top of enclosure. Rig cables as indicated in the tail gun sight controls diagram (figure 406), and connect the turnbuckles. Do not apply the full rigging load until after the guns have been installed.

3. Install canvas boot over base and tighten drawstring.

**(d) MINOR REPAIRS AND REPLACEMENTS.**—Repairs and replacements to guns and mounts must be in accordance with ordnance and armament instructions.

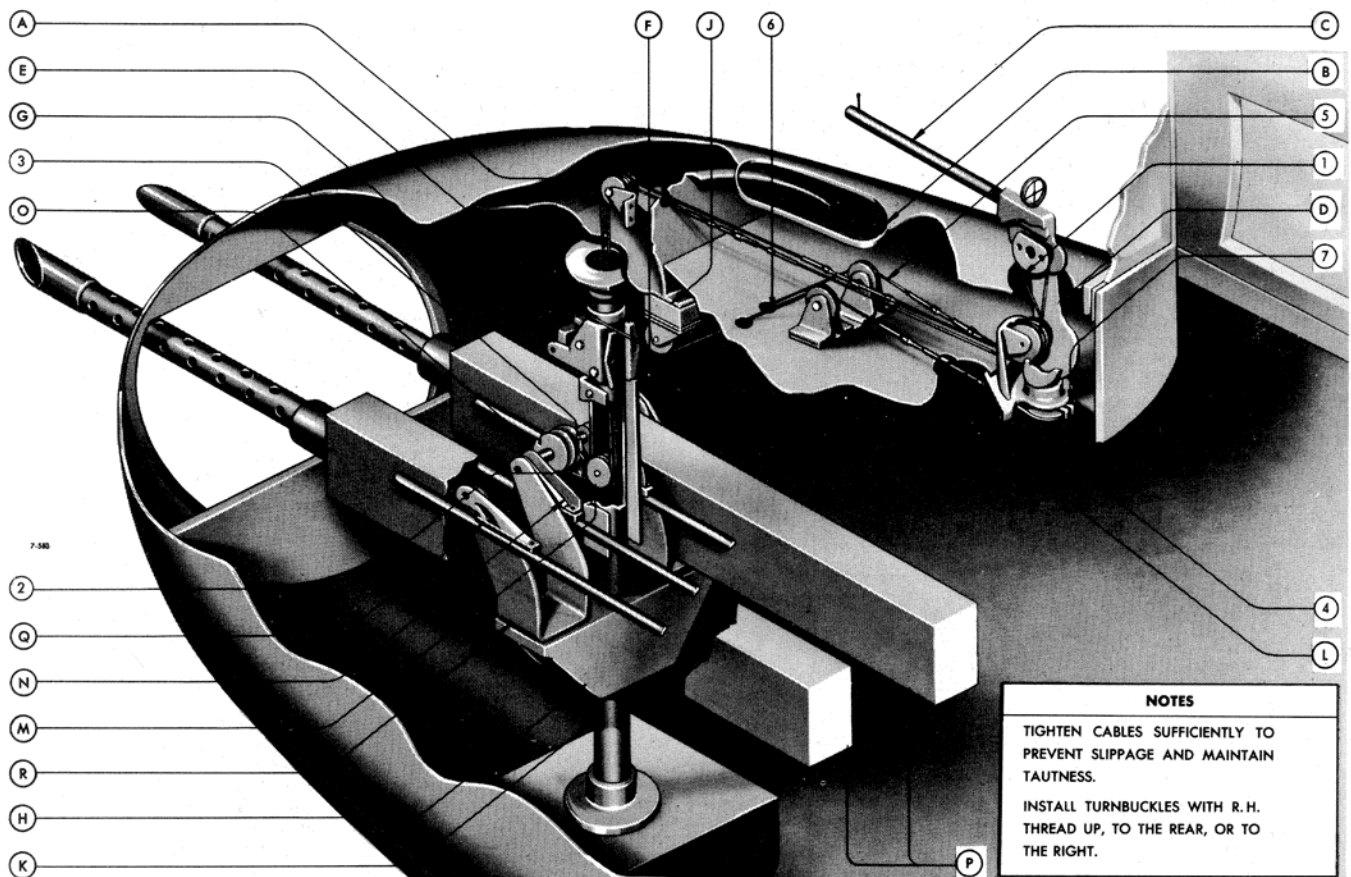
**(8) ARMOR.**

**(a) GENERAL.**—Protective armor plate mounted on rubber cushions is installed at crew stations throughout the airplane. The pilot and copilot are protected by armor plate on the back of their seats. Armor plate for the top turret is on the bulkhead aft of the turret. The gunner's seat in the bottom turret is made of armor plate. Armor plate in the side gunner's compartment is above and below each side window. On



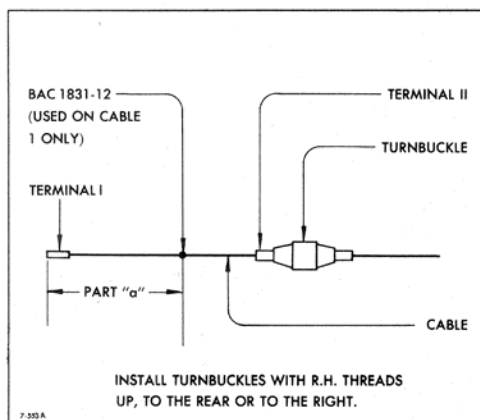
**Figure 405—Tail Gun Flexible Ammunition Feed—Rear View**





LEGEND						
A	CONTROL PULLEYS		AN210-1A	K	MOUNT ASSY.	B.A.C. 15-7518-1
B	CABLE ACCESS DOOR	B.A.C.	6-9326	L	SUPPORT ASSY.	B.A.C. 1-18280
C	SIGHT ASSY.	B.A.C.	3-13519-5	M	CONTROL PULLEY	B.A.C. 1-19083
D	YOKE ASSY.	B.A.C.	1-19087-4	N	BRACKET	B.A.C. 3-20464
E	SHEAVE	B.A.C.	3-20476	O	SHEAVE	B.A.C. 3-20466
F	CHANNEL	B.A.C.	3-20468	P	M-2 .50 CAL. MACHINE GUNS	* * H39B5344
G	TOW TARGET RELEASE	B.A.C.	9-5314	Q	MACHINE GUN ADAPTER ASSY.	* * TYPE E-11 SPEC. 93-24730
H	SUPPORT	B.A.C.	6-9280	R	YOKE ASSY.	B.A.C. 3-13527
J	SPACER	B.A.C.	1-18319			

\*\*GOVERNMENT FURNISHED



		CABLE ASSEMBLY					
CODE	TERMINAL I	LENGTH*		CABLE		TERMINAL II	TURNBUCKLE
		TOTAL	PART "a"	DIA.	TYPE		
1	AN669-2LH	21.83	13.08	1/16	7x7	AN669-2LH	† AN155-BS
2	AN669-2RH	20.30		1/16	7x7	BAC 1828-23	
3	AN669-2RH	24.80		1/16	7x7	BAC 1828-23	
4	BAC 1828-23	5.40		1/16	7x7	AN669-2LH	AN155-BS
5	AN669-2RH	16.80		1/16	7x7	BAC 1828-23	
6	AN669-2RH	16.80		1/16	7x7	BAC 1828-23	
7	BAC 1828-23	5.40		1/16	7x7	AN669-2LH	AN155-BS

† ON BOTH ENDS OF CABLE

\* FOR TERMINAL AN669, THE CABLE ASSEMBLY LENGTH INCLUDES THE FULL LENGTH OF THE TERMINAL.  
FOR BAC 1828, LENGTH OF TERMINAL IS NOT INCLUDED IN CABLE ASSEMBLY LENGTH.

**Figure 406—Tail Gun Sight Controls Installation**



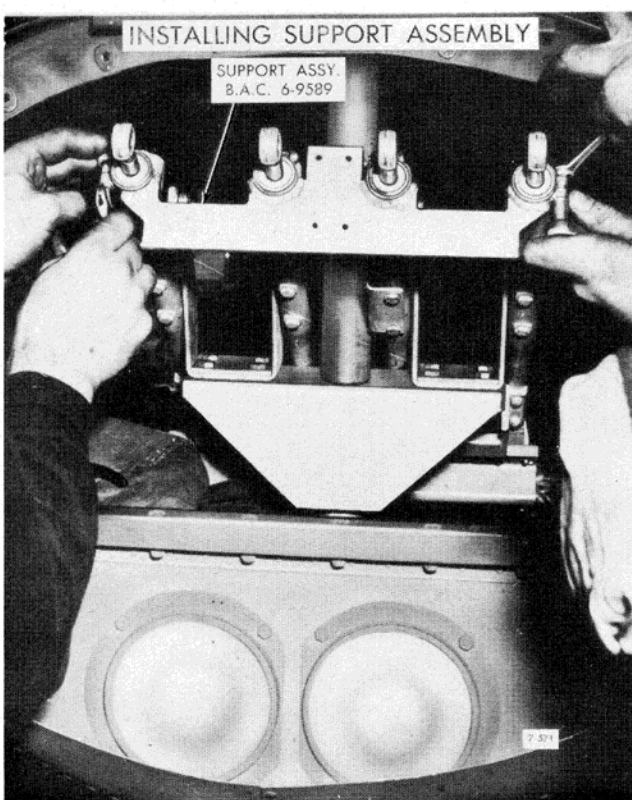
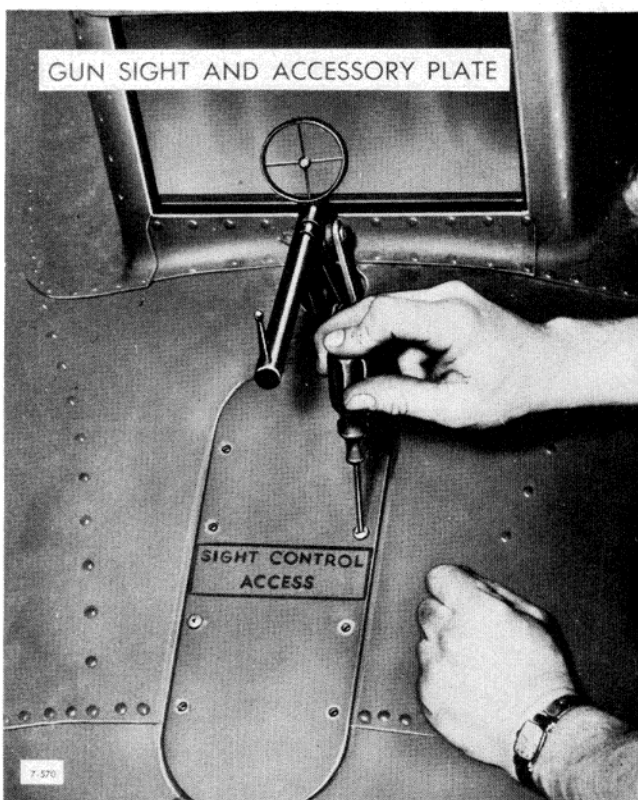
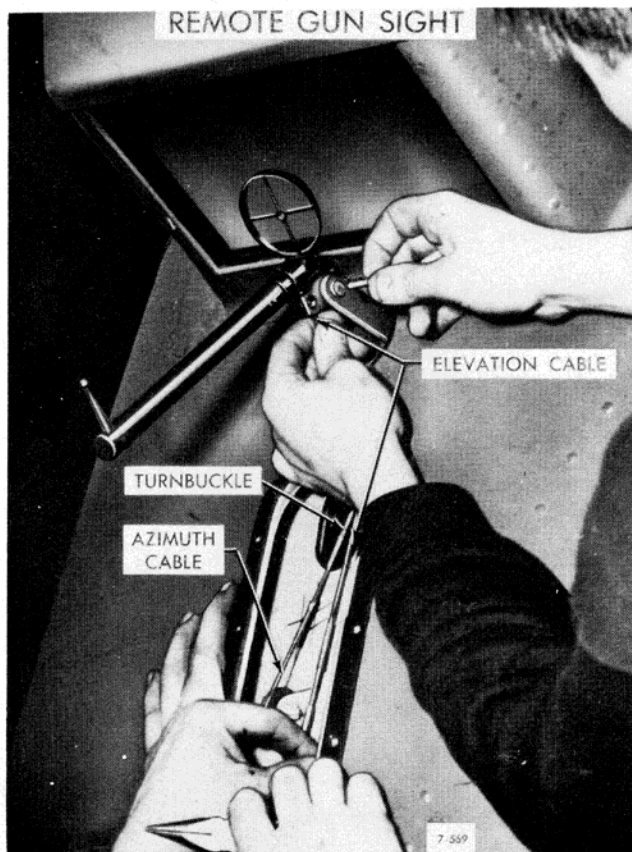
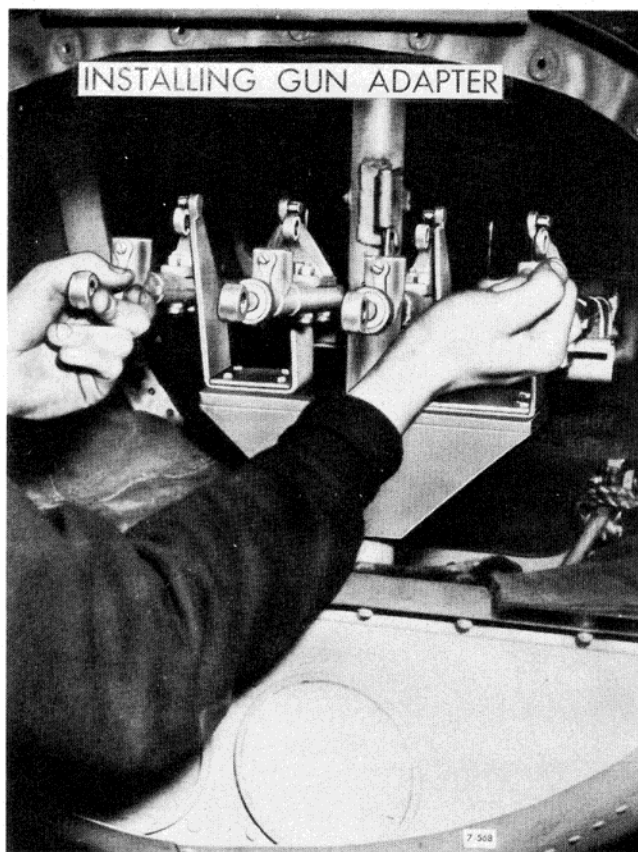


Figure 407—Tail Gun Installation (Sheet 1 of 2)



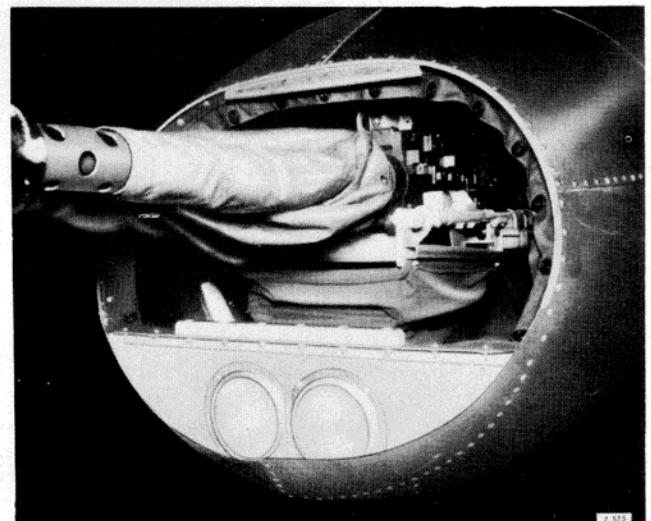
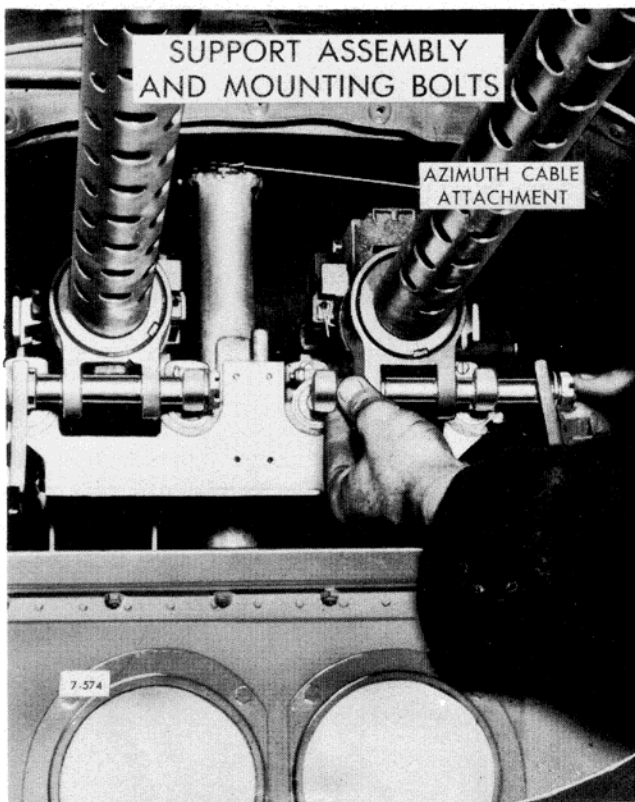
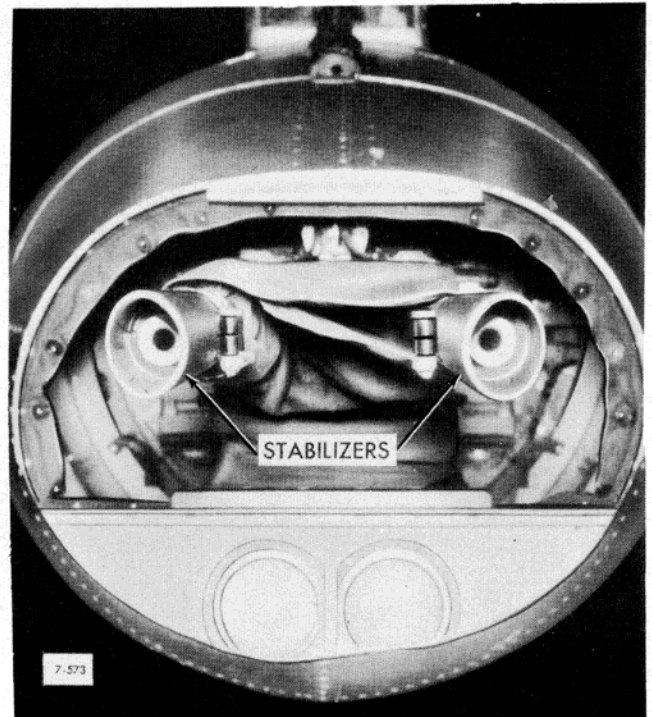
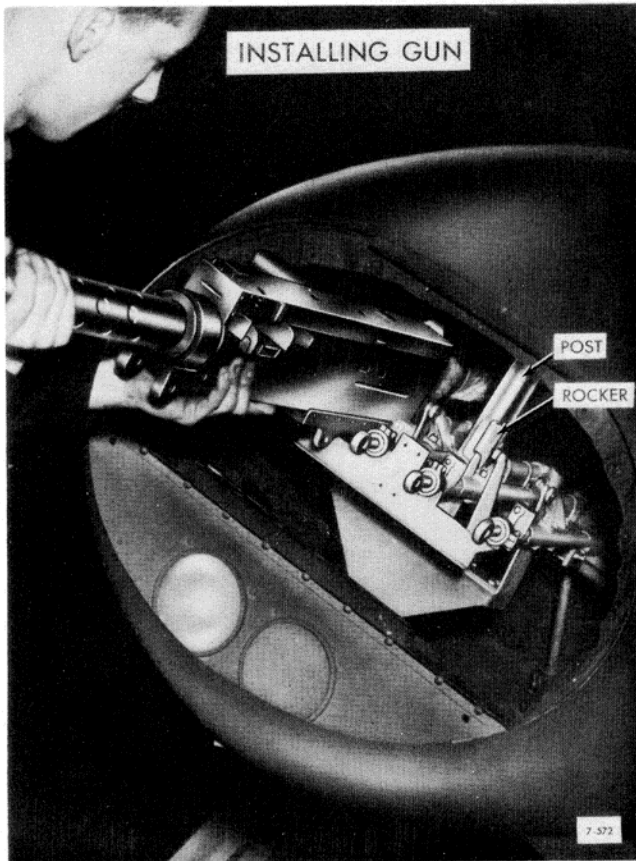


Figure 407—Tail Gun Installation (Sheet 2 of 2)



early airplanes, the servo motors above the tail wheel were protected by armor plate on the sides and bottom. The tail gunner is protected from gunfire from the rear. The padded chest plate is hinged to give access to the guns. The tail gunner's head is protected by bulletproof glass and armor plate.

(b) REMOVAL.—Armor plate is easily removed by disconnecting at the mounting bolts. Support armor while disconnecting to avoid injury to rubber cushions. When the seat back armor for radio operator, pilot, and copilot is being removed, do not remove the grounding braid attached to the supporting structure.

(9) BORESIGHTING.

(a) GENERAL.—Boresighting is a method of harmonizing the sight and the guns of the turrets and the tail gun installation. The guns of a unit must be aligned with respect to the unit, with each other and with the sight of the unit. There are several satisfactory methods of boresighting. The choice of a method usually depends on the equipment available. It is very important to use much care in performing all the steps as accurately as possible. This is especially important for turrets that have automatic computing sights.

1. GUN ALIGNMENT.—Gun alignment, that is, locating guns relative to each other, is necessary previous to boresighting only for tail gun installation; since the boresighting operation for turrets has been so arranged that gun alignment is an integral part of the procedure. However, as a means of checking alignment, it is recommended that guns be first aligned by a method different from that employed in the boresighting operation. Three methods are outlined below:

a. USING A SPIRIT LEVEL.

(1) To make the guns laterally parallel:

(a) Elevate or depress the guns to their maximum travel (for upper and lower turrets respectively).

(b) Use a vertical spirit level against the gun side plates to adjust the guns until they are parallel in vertical planes.

(2) To make the guns vertically parallel:

(a) Set the gun yoke at zero elevation.

(b) Use a horizontal spirit level on the cover plate, to adjust the guns until they are horizontal.

b. USING A MIRROR.—To make guns laterally and vertically parallel:

(1) Level turret body and set gun yoke at zero elevation.

(2) Place a mirror perpendicular to gun bore.

(3) Insert boresighting tools in gun muzzles, as shown in the boresighting diagram.

(4) Align vertical and horizontal cross hairs of the telescope with their images in the mirror.

c. MEASURING.—To make guns laterally

parallel, use a finely graded scale, adjust guns until distances between backplates and muzzles are the same.

**Note**

All of these gun alignment methods give satisfactory results; therefore, convenience alone will determine which shall be used in any given set of circumstances.

2. ALIGNMENT ADJUSTMENTS.

a. HORIZONTAL.

(1) Power turrets: Adjust lateral screw.

(2) Tail guns: Reshim the front trunnion between gun and adapter.

b. VERTICAL.

(1) Power turrets: Adjust lock nuts on the vertical bolt at the rear trunnion.

(2) Tail guns: Reshim at the micarta spacer at the rear gun support.

3. BORESIGHTING PROCEDURE.

a. GENERAL.—The following procedures outline steps which insure the alignment of the guns with the unit, with each other and with the sight of the unit. The guns can be adjusted for converging or parallel fire. It is necessary to perform all steps as accurately as possible.

b. CONVERGING FIRE.—With the converging fire procedure both the sight and the guns of a unit are directed on a small distinct target approximately 1000 yards away. This method is easier and more accurate than the parallel fire method. Thus, use the converging fire method whenever possible.

**Note**

The sight must be properly adjusted and preliminarily boresighted to align the reticles with the mounting pin holes. When the sight is accurately adjusted and placed in a turret having accurately aligned guns, very little further adjustment should be necessary.

(1) UPPER AND LOWER TURRETS.

(a) ALIGNMENT OF SIGHT TO TARGET.

1. Remove the sight by removing sight mounting pin and disconnecting the azimuth and elevation input shafts at the sight, the electrical conduit, and the range shafts.

2. Set target dimension dial at 20 feet and range dial at 1000 yards.

3. Rotate azimuth and elevation inputs to the sight until azimuth and elevation deflection dials read exactly zero. (The range flexible shaft may be removed from the foot control gearing and used for this purpose.) Replace sight in turret.

4. Remove the lamp housing and lamp from the sight. Direct a light (flashlight or turret trouble light) into the opening so that the reticle image can be seen.



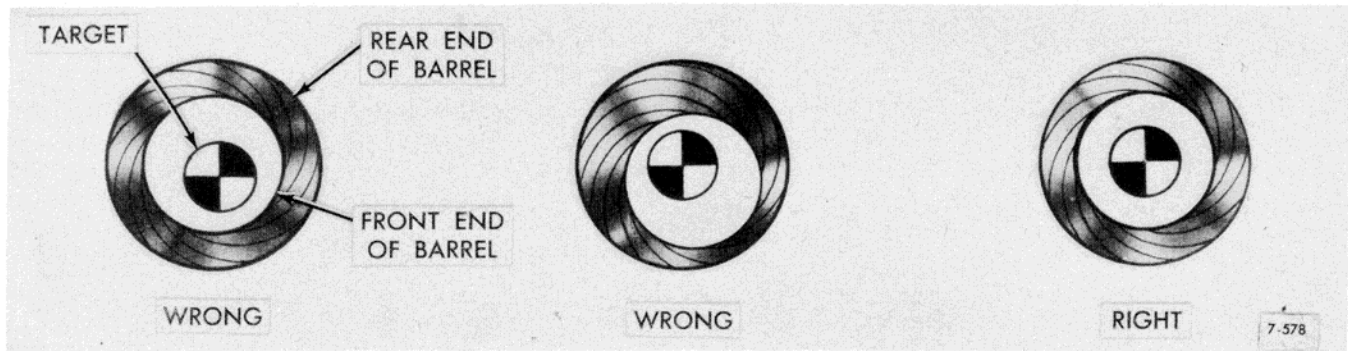


Figure 408—Sighting Target Through Gun Bore

5. Move the turret until reticles are centered on a target not less than 1000 yards away, or on the test target sight marking.

**Note**

The 1000-yard target will align the gun bores to meet at the point selected. The test target will align the gun bores exactly parallel. The theoretical difference of 28 inches at 1000 yards is negligible.

(b) ALIGNMENT OF GUNS TO SIGHT.

1. Align the guns accurately on the target by making lateral and vertical gun trunnion adjustments. (A muzzle boresight tool should be used if available, otherwise sight through gun bores.)

**Note**

When sighting through gun bores be sure that circle at front end of barrel is concentric with circle at rear of barrel, as shown in figure 578.

2. Tighten adjustment bolts, and replace lamp and lamp housing on sight. If guns cannot be made to align with sight, the sight should be made to align with guns by the following procedure:

a. Adjust one gun so that the lateral and vertical adjustments are approximately at the midpoint of travel.

b. Tighten adjustment bolts and move the turret so that this gun is aligned on a target at approximately 1000 yards.

c. Adjust other gun to align on same target.

d. Remove the window plate on the sight over the deflection dials.

e. With deflection dials set at zero, with range set at 1000 yards, and target dimension at 20 feet, adjust the azimuth and elevation thumbscrews to align reticle on the target. The thumbscrews move the optic head and do not move the computing mechanism.

f. Replace sight and turret parts.

(c) ALIGNMENT OF SIGHT TO TURRET.—After the boresighting operations have been performed, make sight corrections to the turret as follows:

1. Run turret exactly to zero azimuth and zero elevation.

2. Remove sight from mounting bracket.

3. Using loose piece of flexible shaft, set sight elevation and azimuth dials at zero. Attach azimuth flexible shaft to sight rather than to turret gearing.

4. Connect "AN" plug into receptacle on sight and replace sight in its mounting bracket. Be sure that azimuth dial is at zero.

5. Connect azimuth flexible shaft into turret azimuth end bell gearing. Connect elevation flexible shaft from elevation-to-sight gear box into sight elevation input.

6. Place sight in position and insert the mounting pin.

7. With range flexible shaft disconnected from foot range control, connect one end to sight range input. Rotate shaft until range dial is as far below zero as possible. The dial should be approximately -40. (There is no marking on the range dial below zero; this position may be estimated.) Back off the shaft an amount corresponding to one tooth on the shaft spline. This position of shaft insures that foot range control stops will limit rotation of shaft so that sight will not be damaged.

8. Connect the flexible shaft to the foot range control. Check travel of the sight range dial while slowly moving the foot pedal. Control should be from below zero to over 1000 yards. Be sure that flexible shaft is free of kinks and bends which will cause binding and jerky action.

**CAUTION**

Do not operate turret under power with sight installed unless sight motor is running. Failure to observe this precaution may result in serious damage to sight.

c. PARALLEL FIRE.

(1) GENERAL.—With the parallel fire procedure the sight line and the flight path of the bullets from the guns are parallel. The error involved by this procedure (instead of directing both the sight line and the line of fire at the target) is unimportant because the



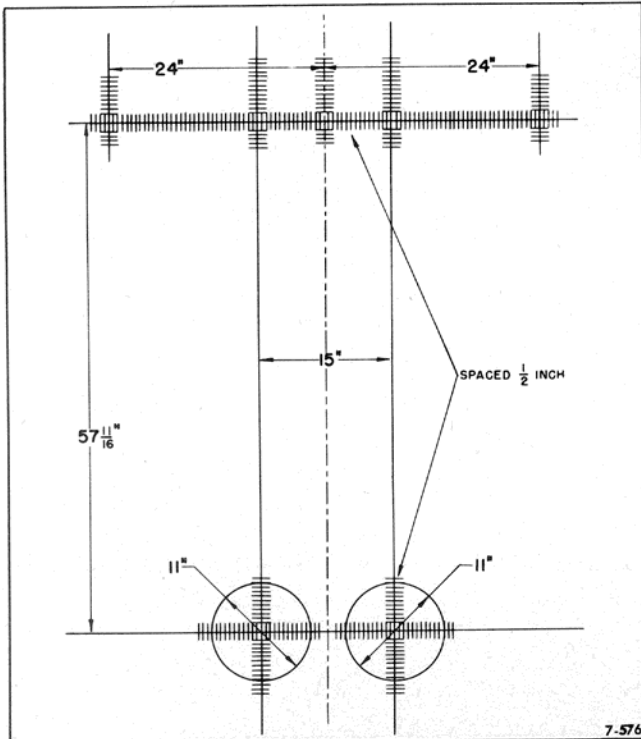


Figure 409—Chin Turret Sighting Board

distance between the sight and the gun bore is small and the gun mount vibration causes an inherent scattering effect. This method can be used in the shop or in the field. Targets are set up relative to the airplane so that accurate boresighting can be accomplished regardless of the airplane's attitude.

(2) BORESIGHTING CHIN TURRET.

(a) Place the airplane in near level position.

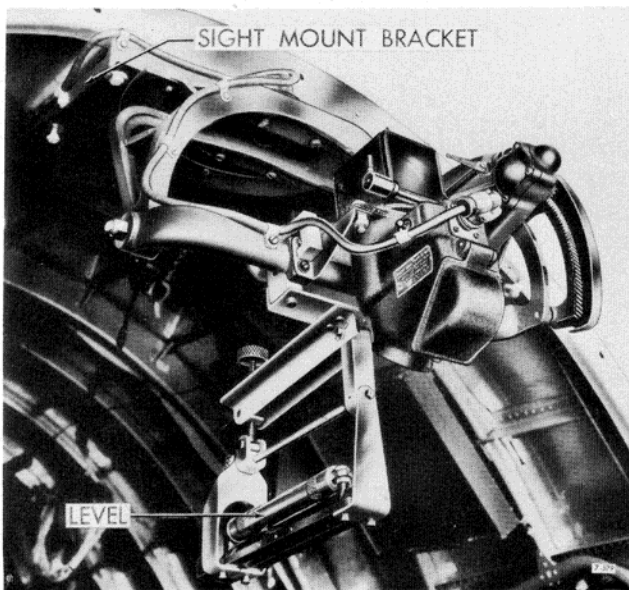


Figure 410—Sight Mount and Level

(b) Use level shown in figure 413, if available, or tape a small bench level on top of the right gun near the muzzle.

(c) Level the guns pointing straight forward and place the level shown in figure 410, if available, or a small bench level on the top of the N-6 sight. The level must be straight forward and secure. It need not indicate precisely level, but the position of the bubble should be noted.

(d) Rotate turret approximately 80 degrees to right, level the guns by means of the hand elevation crank. Note position of the sight level bubble at this azimuth.

(e) Rotate 80 degrees to left, re-level guns, and again note the position of the sight level bubble. This will indicate the relative plane in which the sight has rotated with respect to the guns. If the bubble has changed position during the operation, it

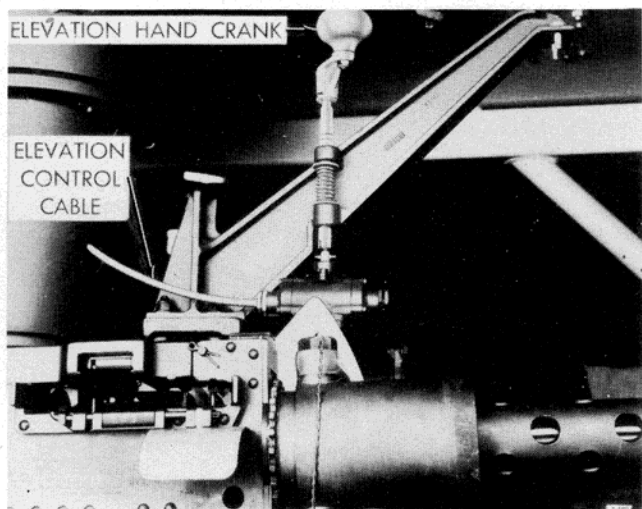


Figure 411—Elevation Mechanism

will be necessary to adjust the sight mount bracket to allow the sight to rotate in the same plane with the gun mount. During this adjustment, the attaching bolt lock nuts must be set up lightly to prevent any movement of the bracket while the new settings are being tested.

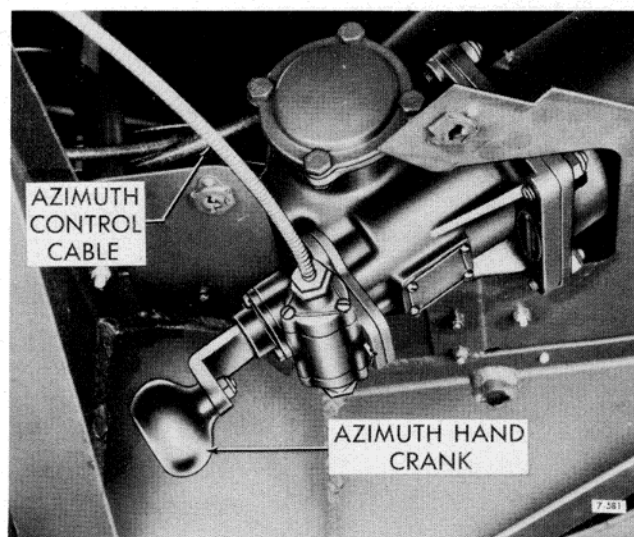
(f) Adjust the sight to parallel elevation by disconnecting the elevation cable at the turret (not at the sight), rotating the square shaft as required to level the bubble, and reconnect the cable.

(g) After the above adjustments have been made, the guns and sight must be harmonized with sighting boards.

(h) The sighting boards, (refer to figure 409), are placed 1000 inches from the turret, one placed straight forward and one on either side of the airplane at 90 degrees from the center line.

(i) Disconnect the elevation power cable so that the turret may be operated in azimuth only.



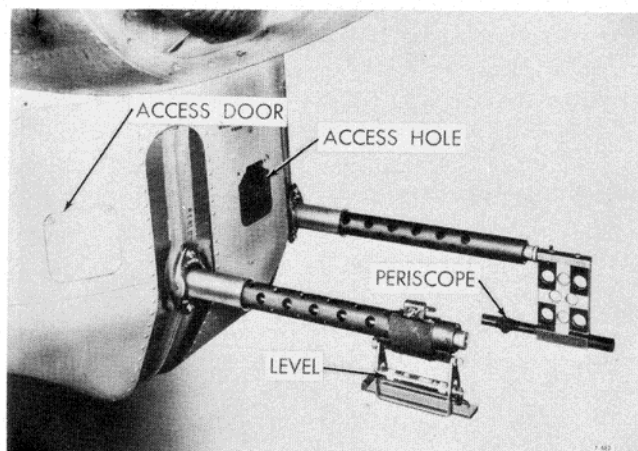


**Figure 412—Azimuth Mechanism**

(j) The turret should be positioned on the zero azimuth scribed line and the guns brought to an approximately level position in elevation, and then all three boards adjusted to proper height and angularity. A good check to see if boards are properly lined is to see if periscope will stay on vertical line when turret is elevated.

(k) When all sighting boards are properly adjusted, the guns are again set on zero azimuth and on their respective lines on the forward target. Check the position of the sight on the target. If not on the center line and at the theoretical height as indicated on target, set it in place by disconnecting the azimuth and elevation cables and adjusting sight by hand until it is exactly on.

(l) Check to see if guns are still in their correct position. Rotate the turret to each of the two side boards. The sight should be the same height above guns as when it was in the forward position. If not, make minor adjustments on sight bracket to compensate. When this is complete, return guns and sight to forward target and locate properly.



**Figure 413—Periscope and Level**

(m) A fourth target will be set up in the same manner as the forward target but at a distance of 500 inches. Note the position of the sight on this target. If it is not in the same location as the forward target, then proper adjustment must be made to give parallel fire in azimuth as well as elevation. No diverging will be allowed. The maximum amount of convergency should not exceed three inches per 500 yards, or two inches at 1000 feet. After this check is complete, the sight should be placed on an object not less than 300 yards away. Check to see if the proper relation still exists between the sight and guns by using the periscope.

(n) Reinstall the turret tub. The minimum distance between the tub and any part of the well is 1/8 inch. The minimum distance between the fairing and the guns or tub is 3/16 inch. For flight, the guns must be stowed pointing forward at 26 degrees elevation.

### (3) BORESIGHTING LOWER SPHERICAL TURRET.

(a) Carefully install the target as shown in figure 414.

(b) Check gun alignment.

(c) Disconnect three flexible shafts from sight.

(d) Set the target dimension dial at 20 feet, and the range dial at 1000 yards in order to make the reticles appear as a single cross hair.

(e) With the sight off, rotate the azimuth and elevation in-put shafts in either direction until the deflection dials, located at the side of the sight, read zero.

(f) Insert in the muzzle of each gun a boresighting tool assembly as shown in figure 414. Position the turret by means of the azimuth and elevation hand cranks, and adjust the guns so that the cross-hair image projected from the telescope coincides with its target on the target board. (If the guns have been previously aligned, gun adjustment will not be necessary.)

(g) Remove bulb housing cover and bulb from rear sight, and direct a light into the bulb housing, thus causing the reticles to appear in the optics.

(h) Check alignment of sight with guns, by sighting at the target marked for the sight on target board. Adjust the optics to direct the center of the cross hairs at the target. Adjusting screws are provided for this purpose on the deflection shafts just above dials.

(i) Replace the sight bulb and the sighting station at its reference position (zero azimuth and zero elevation).

(j) If electric power is available, turn on the sight to set the azimuth and elevation dials on the sight at zero. Attach all of the flexible shafts to their respective connections. The elevation in-put shaft is on the left and is attached to the fire cut-off box.

(4) BORESIGHTING TOP TURRET.—The boresighting procedure for the top turret is iden-



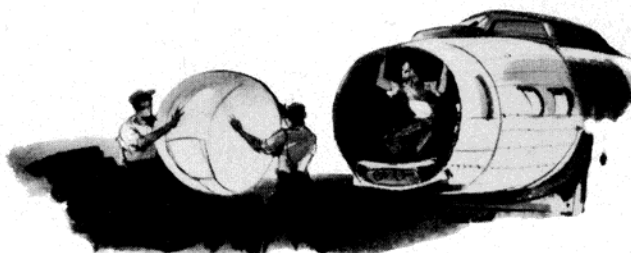


sighting of the tail guns, since it is impossible to attach the target to the airplane. The target position is therefore based on accurate gun alignment.

- (b) Fix the guns approximately in the horizontal position (the stowage lock is adequate) and insert in the muzzle of each gun a boresighting tool assembly (figure 414).

- (c) Locate the target board stand at any convenient distance from the airplane and adjust its height and attitude so that the cross-hair image projected from each telescope coincides with its target on the target board. During this operation the target must be kept as nearly vertical as possible.

- (d) Set the sight on its target by adjusting the turnbuckle installed on control cables.





## SECTION II

### USEFUL OR MILITARY LOAD WEIGHT AND BALANCE



#### 1. BOMB LOADING.

Install the external bombs according to the External Bomb and Rack Installation Diagram and the Bomb Hoisting Diagram. Attach the front and rear beam support brackets at wing station 2, and the required sway brace angles at wing station 1. (All attaching bolts and screws are located in position on the wing of the airplane and must be replaced when the rack is detached.) Remove the fuel pump access blister. Adjust the sway braces to the proper bomb diameter and locate for the shackle being used. Lift the rack into position and connect to the support brackets. Adjust the sway brace strut with the turnbuckles, and the quick connect joint with the check nut. The upper part of the control rod must be turned completely into the wing fittings at all times. Adjustments for length shall be made by turning the lower part of the control rod in the end fitting and locking with the check nut.

a. Lower the rack to the ground and install the pulleys, cables, and hoists. (The internal bomb hoists are used on the external racks.) Set the release rod in the "LOCKED" position, cock the arming lever, install the shackle, and cock the release lever. Connect the shackle to the bomb.

#### CAUTION

*The release unit control rod on the rack must be moved to the "LOCKED" position and securely fastened before the bomb and rack are hoisted to prevent accidental release of the bomb during the hoisting procedure.*

b. Hoist the bomb and rack in the level position and attach the aft end to the support bracket. Hoist the forward end and attach to the support. Attach the sway braces to the support angles, and remove the hoists, pulleys, and cables. Check to see that the bomb release lever in the bombardier's compartment is in "LOCKED" position and connect the electrical and mechanical controls. *Remove the mechanical control rod locking device.*

#### CAUTION

If bombs are carried above the 2,000-pound bomb, they **MUST NOT BE RELEASED** until the D-6 shackle and adapter have been removed. This definitely requires selective release control for a mixed load which contains one or more 2,000-pound bombs.

#### 2. AMMUNITION LOADING.

The following procedure is recommended when loading the ammunition boxes and guns. The guns should be horizontal. The guns should be pointed to the left side of the airplane when loading the left gun and to the right when loading the right gun.

a. Remove the rear floor panel.

b. Lift the ammunition box cover from the box.

c. Start the ammunition belt into the container from the front, that is, the end of the container on which the roller is mounted. The shells must point toward the center column.

d. Completely fill the box by laying the ammunition back and forth in layers. When the top of the box is reached, feed the belt over the top of the roller.



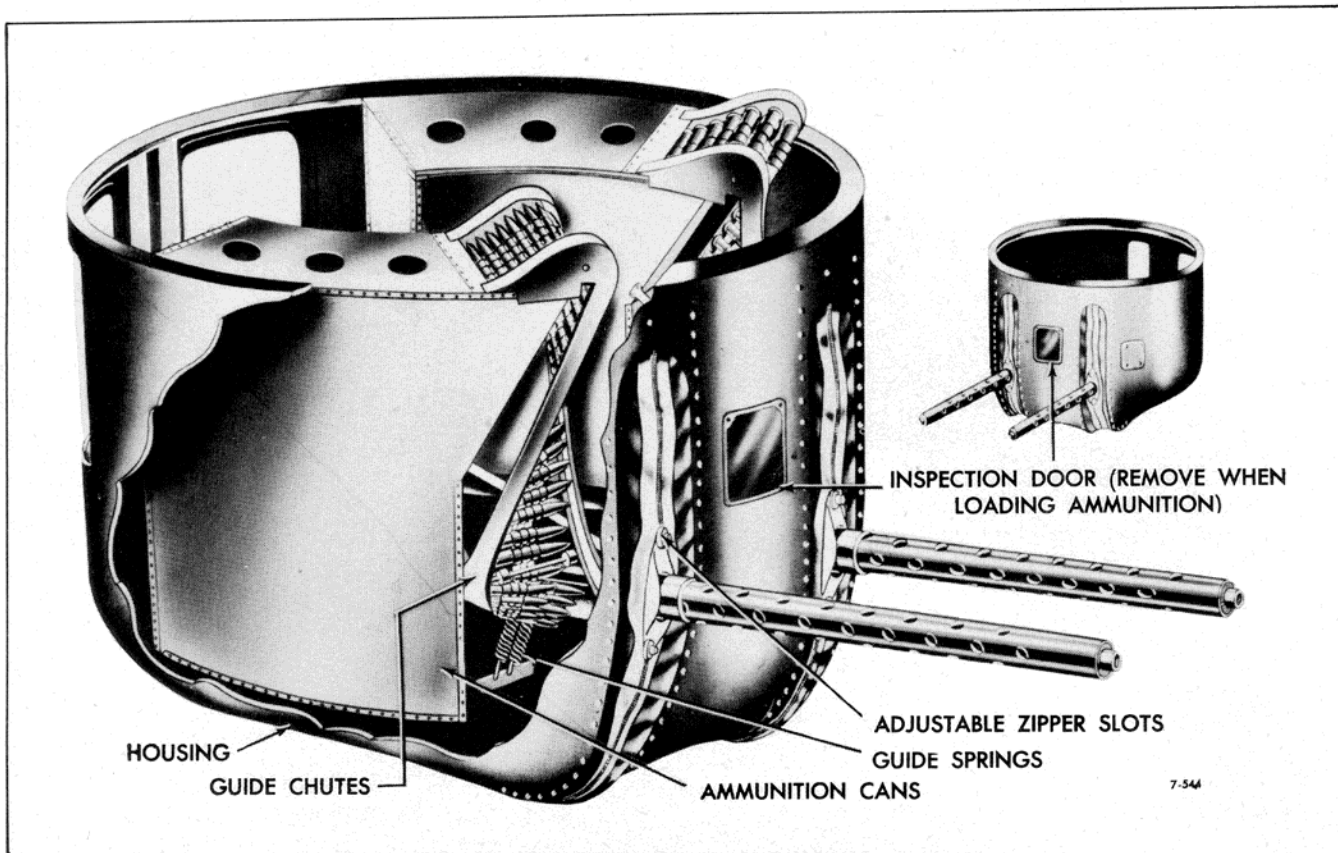


Figure 415—Ammunition Box and Loading

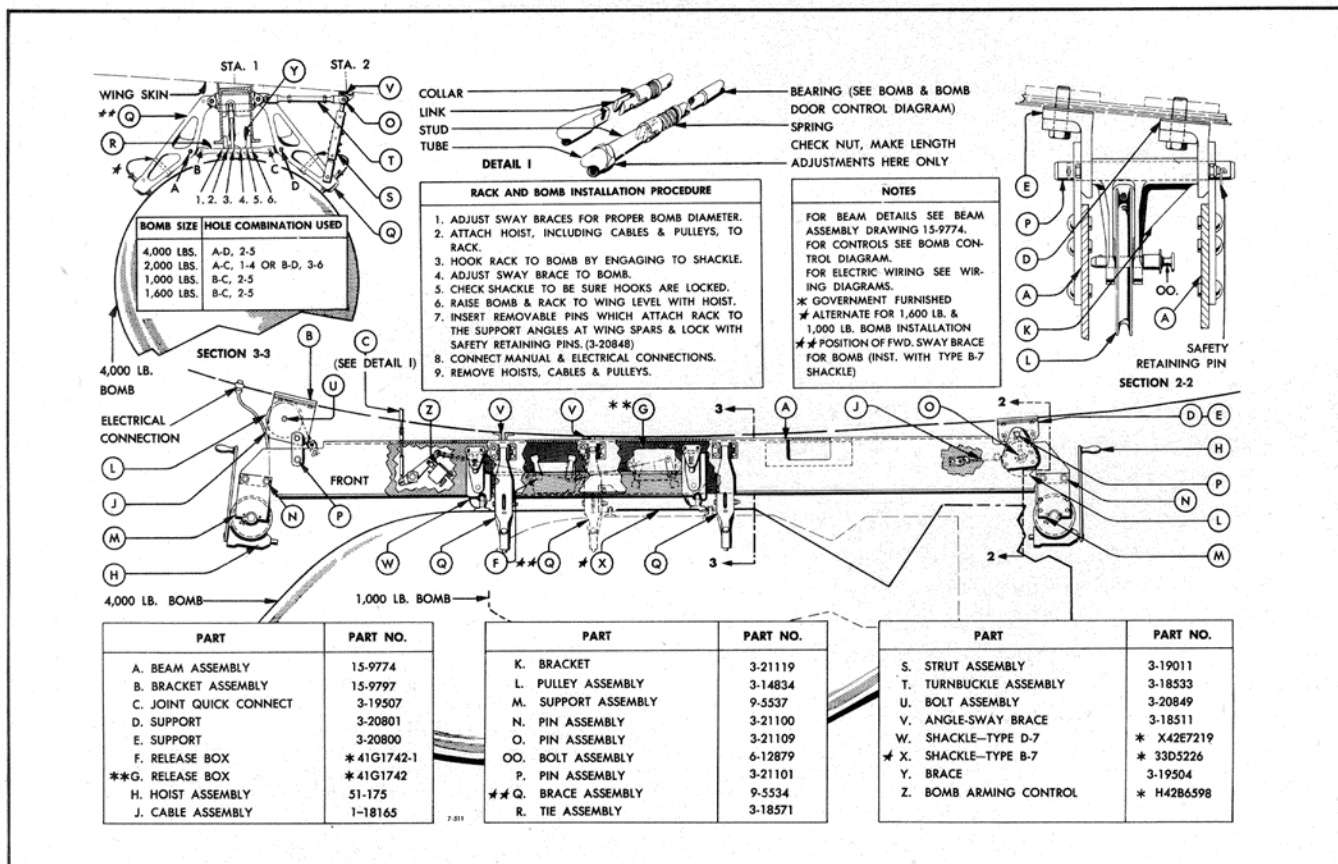


Figure 416—External Bomb and Rack Installation



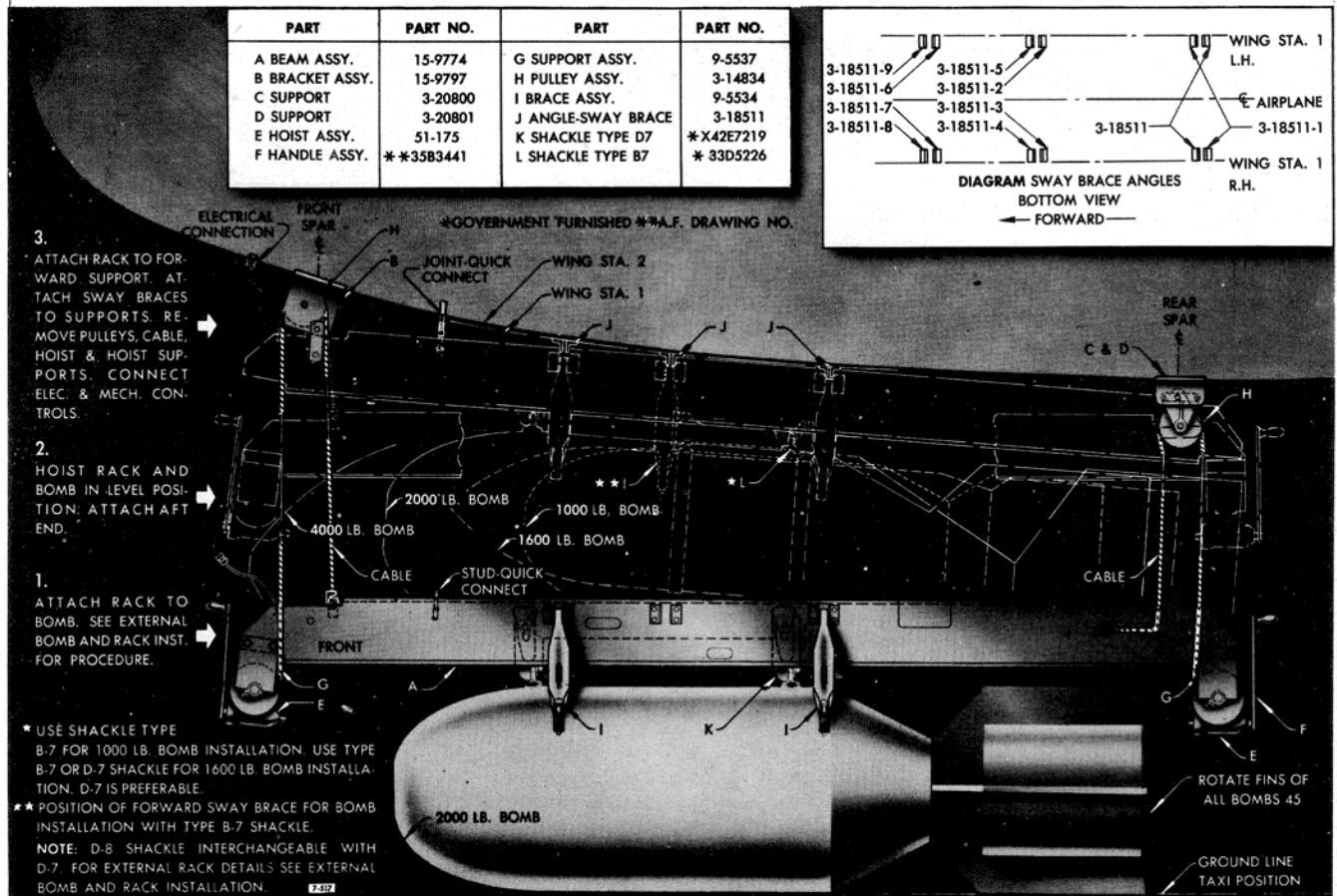


Figure 417—Bomb Hoisting Diagram—External Bombs

**Note**

The double link always feeds into the gun first.

e. Replace the box cover. The belt of ammunition is threaded down through the guide rails and underneath the lower roller of the gun.

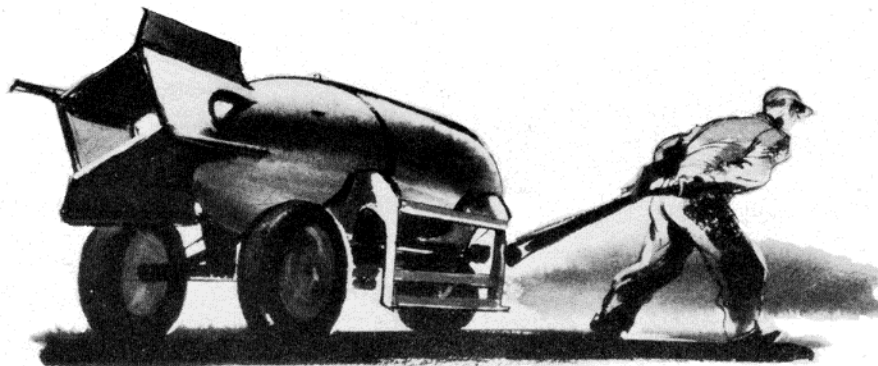
f. The ammunition rides on the guide springs as it is fed into the guns. The two springs are hooked to the

side of the movable housing. The short spring is attached to the ammunition container by a wire clip. The springs must be attached to the guns to support the shells as they enter the guns.

g. Revolve the turret to the right side of the airplane and load the other ammunition box in a similar manner.

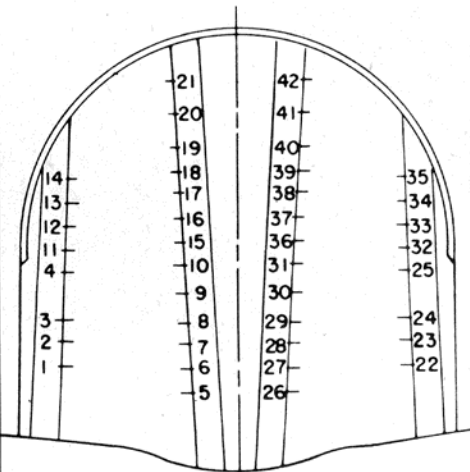
b. Replace the floor cover.

i. Charge the guns.





WT.	TYPE	USE	STATIONS	SWITCHES ON L.H. & R.H. RACKS				SWITCHES ON L.H. ONLY   R.H. ONLY			
				SEQ.	STA.	SEQ.	STA.	SEQ.	STA.	SEQ.	STA.
100	M38A2	PRAC.	1,3,4,5,7,9,12,14,15,17,19,21; 22,24,25,26,28,30,33,35,36,38,40,42.	1	1	22	32	1	1	1	22
100	M47A1 & M47A2	CHEM.		2	22	23	12	2	2	2	23
108	AN-M30	G.P.		3	2	24	33	3	3	3	24
125	MIAI & M2AI	FRAG-CLUS	1,3,4,5,7,9,12,14,15,17,19,21; 22,24,25,26,28,30,33,35,36,38,40,42.	4	23	25	13	4	4	4	25
				5	3	26	34	5	5	5	26
				6	24	27	14	6	6	6	27
140	AN-MI	INCEN.	1,3,4,5,7,9,12,14,15,17,19,21; 22,24,25,26,28,30,33,35,36,38,40,42.	7	4	28	35	7	7	7	28
				8	25	29	15	8	8	8	29
				9	5	30	36	9	9	9	30
				10	26	31	16	10	10	10	31
				11	6	32	37	11	11	11	32
250	AN-M57	G.P.	2,4,6,9,13,16,19,21,23,25,27,30,34,37,40,42.	12	27	33	17	12	12	12	33
300	M31	DEM.	2,4,6,9,13,16,19,21,23,25,27,30,34,37,40,42.	13	7	34	38	13	13	13	34
				14	28	35	18	14	14	14	35
				15	8	36	39	15	15	15	36
325	AN-MK17MOD.2	DEPTH	7,10,18,21,28,31,39,42.	16	29	37	19	16	16	16	37
				17	9	38	40	17	17	17	38
500	AN-M2	INCEN-CLUS	3,10,18,21,24,31,39,42.	18	30	39	20	18	18	18	39
500	AN-M64	G.P.	2,7,10,11,18,21,23,28,31,32,39,42	19	10	40	41	19	19	19	40
500	AN-M43	G.P.		20	31	41	21	20	20	20	41
500	AN-M58	SEMI-A.P.	2,4,6,9,13,16,19,21,23,25,27,30,34,37,40,42.	21	11	42	42	21	21	21	42
600	M62 & M62AI	A.P.	2,4,6,9,13,16,19,21,23,25,27,30,34,37,40,42.								
600	M62A2	A.P.									
600	M32	DEM.									
650	MK29	DEPTH	8,16,20,29,37,41.								
800	M61	A.P.	2,6,9,16,19,23,27,30,37,40.								
900	M60	A.P.									
1000	AN-MK33	A.P.									
1000	AN-M59	SEMI-A.P.	7,10,18,21,28,31,39,42.								
1000	AN-M44	G.P.	8,16,20,29,37,41.								
1000	MK13 MOD.1	MINE									
1000	AN-M65	G.P.									
1000	M52 & M52AI	A.P.	2,6,9,16,19,23,27,30,37,40.								
1100	M33	DEM.	8,17,29,38.								
1600	AN-MK1	A.P.	7,10,18,28,31,39.								
2000	AN-M34	G.P.	10,31								
2000	AN-M66	G.P.									
BOMB BAY TANKS			1,6,22,27.								
1000	M52 & M52AI	A.P.	EXTERNAL BOMB RACKS								
1000	AN-MK33	A.P.									
1000	AN-M59	SEMI-A.P.									
1000	MK13 MOD.1	MINE									
1000	AN-M44	G.P.									
1000	AN-M65	G.P.									
1600	AN-MK1	A.P.									
2000	AN-M34	G.P.									
2000	AN-M66	G.P.									
4000	AN-M56	LIGHT-CASE									



REAR VIEW  
NUMBERS IDENTIFY BOMB STATIONS

ANY UNLOADED STATION OR LOADED UNCOCKED STATION WILL BE AUTOMATICALLY SKIPPED FROM THE SEQUENCE (SEQ.) AND THE REMAINING STATIONS OPERATED IN THE SEQUENCE NAMED.

OVERLOAD GROSS WT. 48,726 LBS.  
DESIGN USEFUL BOMB LOAD 2064 LBS.  
MANUAL CONTROLS RELEASE BOMB BAY TANKS.

UNDERLINED STATIONS SHOW OVERLOAD.  
STATIONS IN ○ SHOW REDUCED FACTOR AND OVERLOAD.

7-510

Figure 418—Bomb Loading Chart



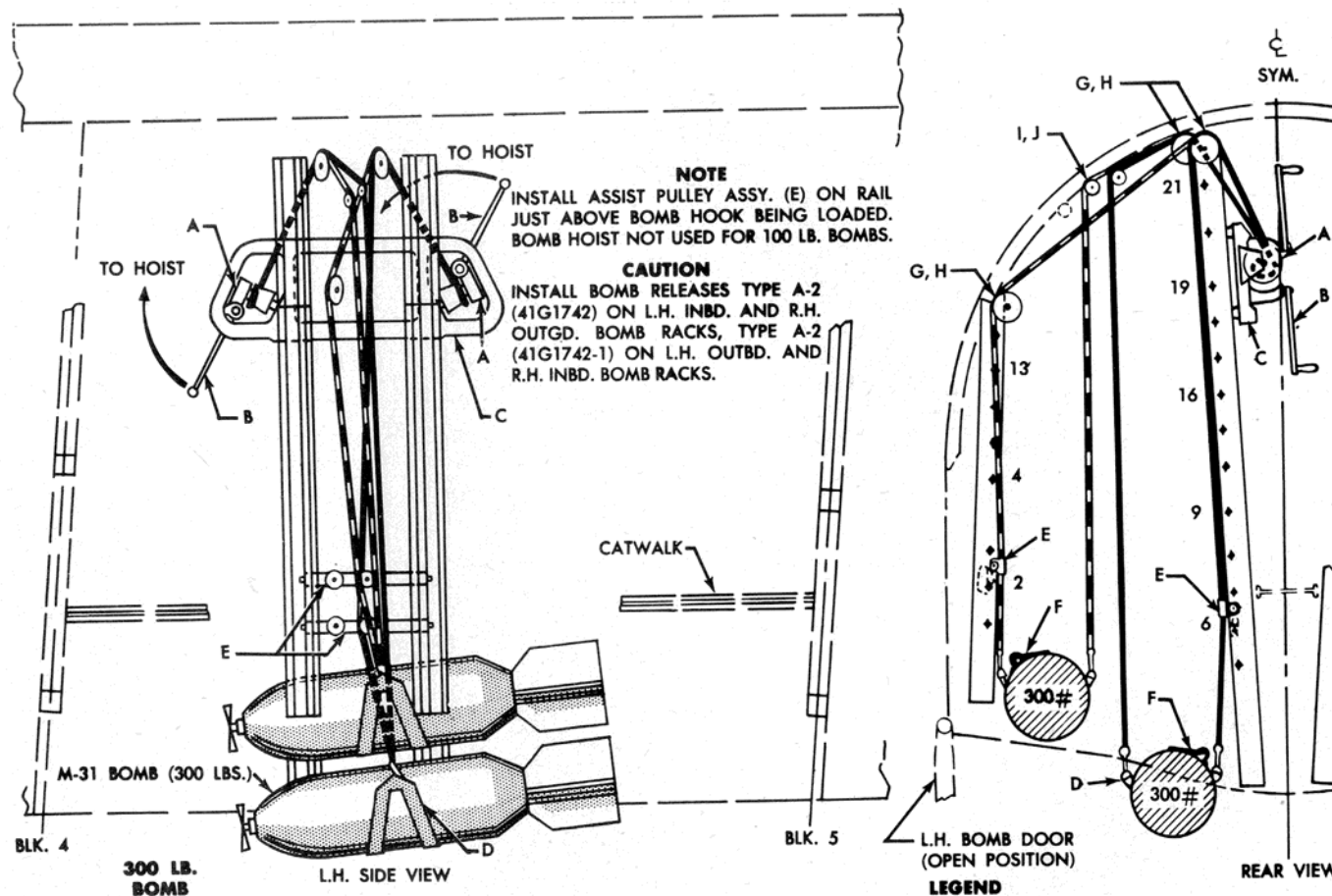


Figure 419—Bomb Hoisting Diagram—300-lb. Bomb



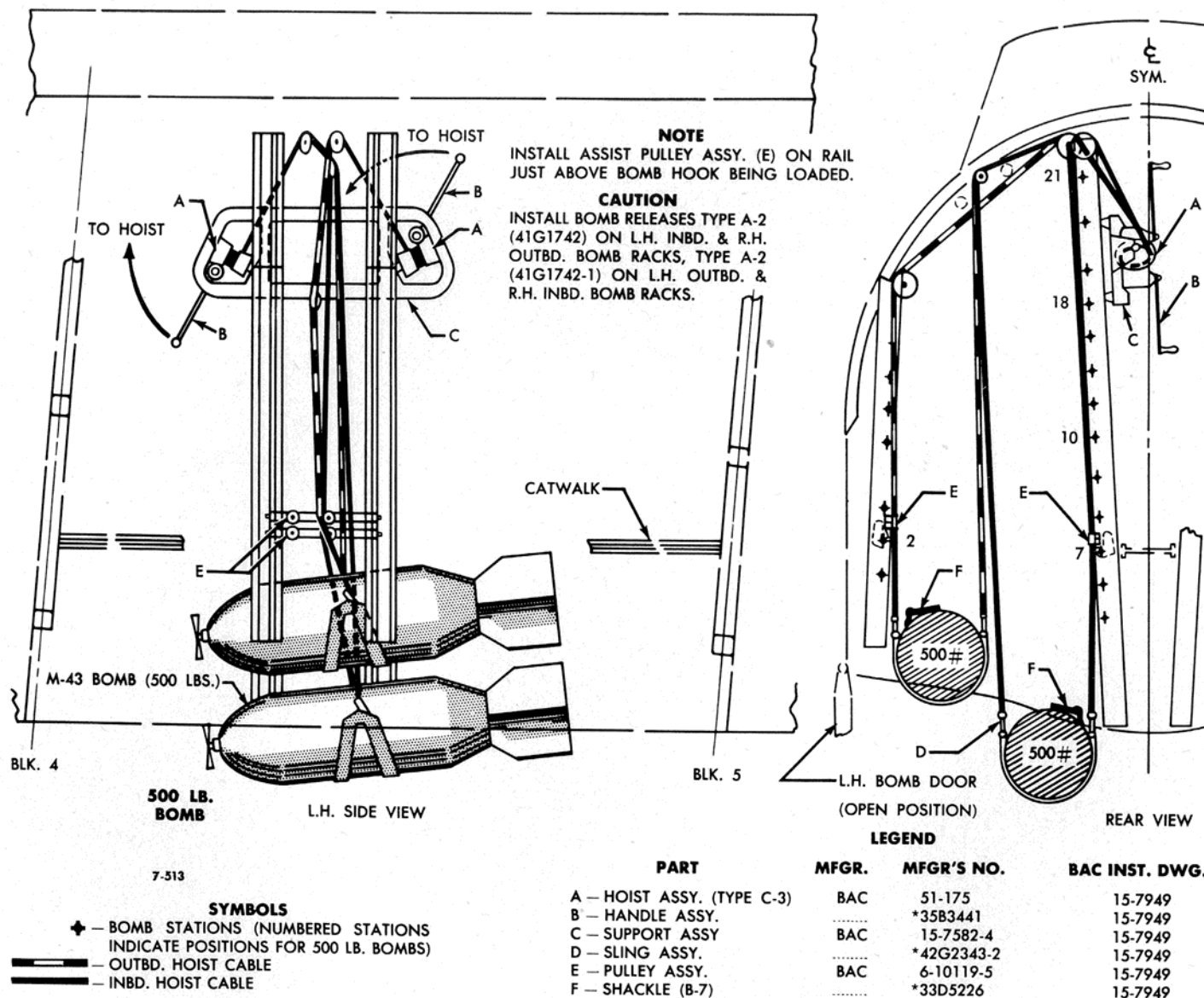


Figure 420—Bomb Hoisting Diagram—500-lb. Bomb



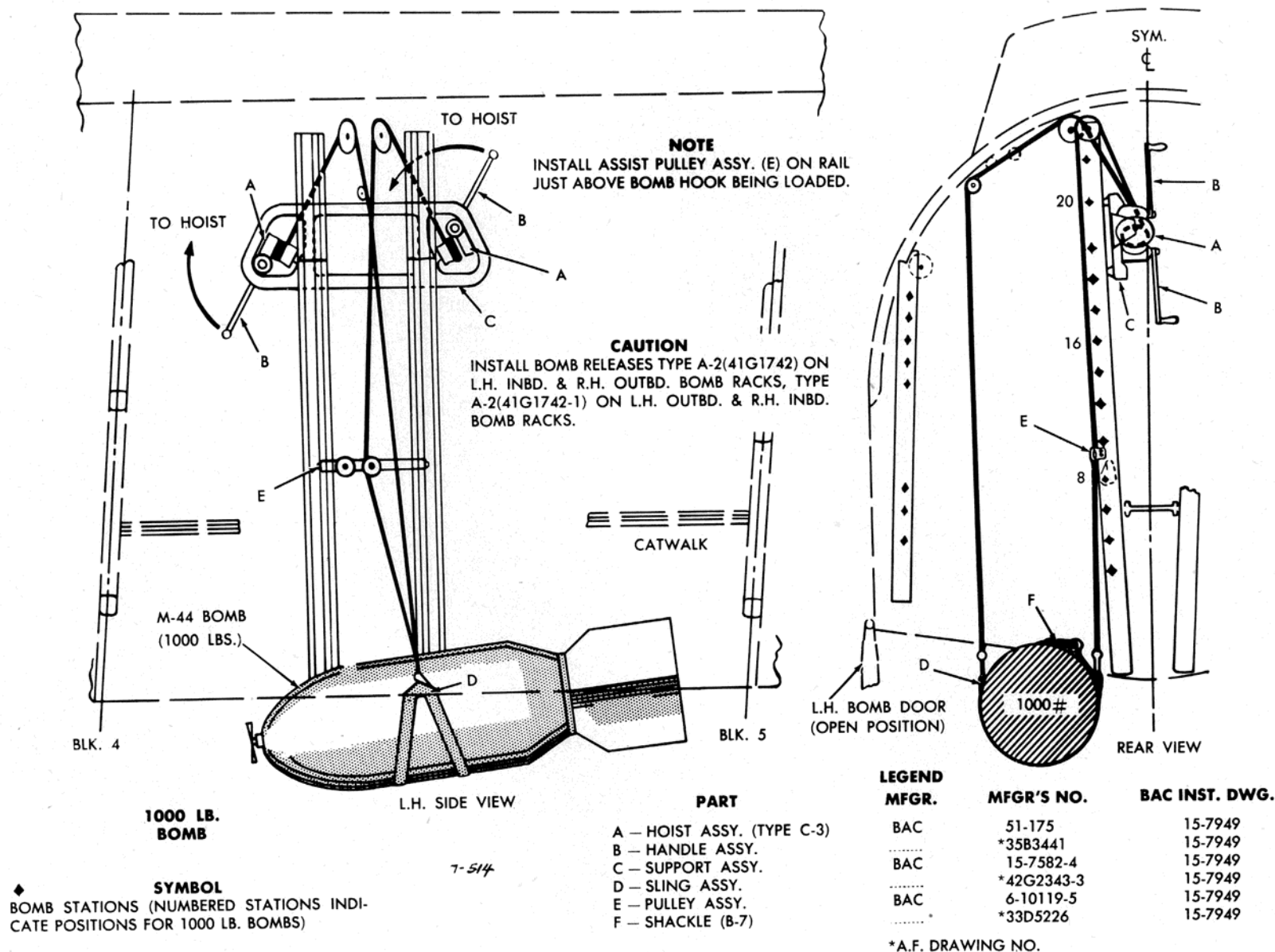


Figure 421—Bomb Hoisting Diagram—1000-lb. Bomb



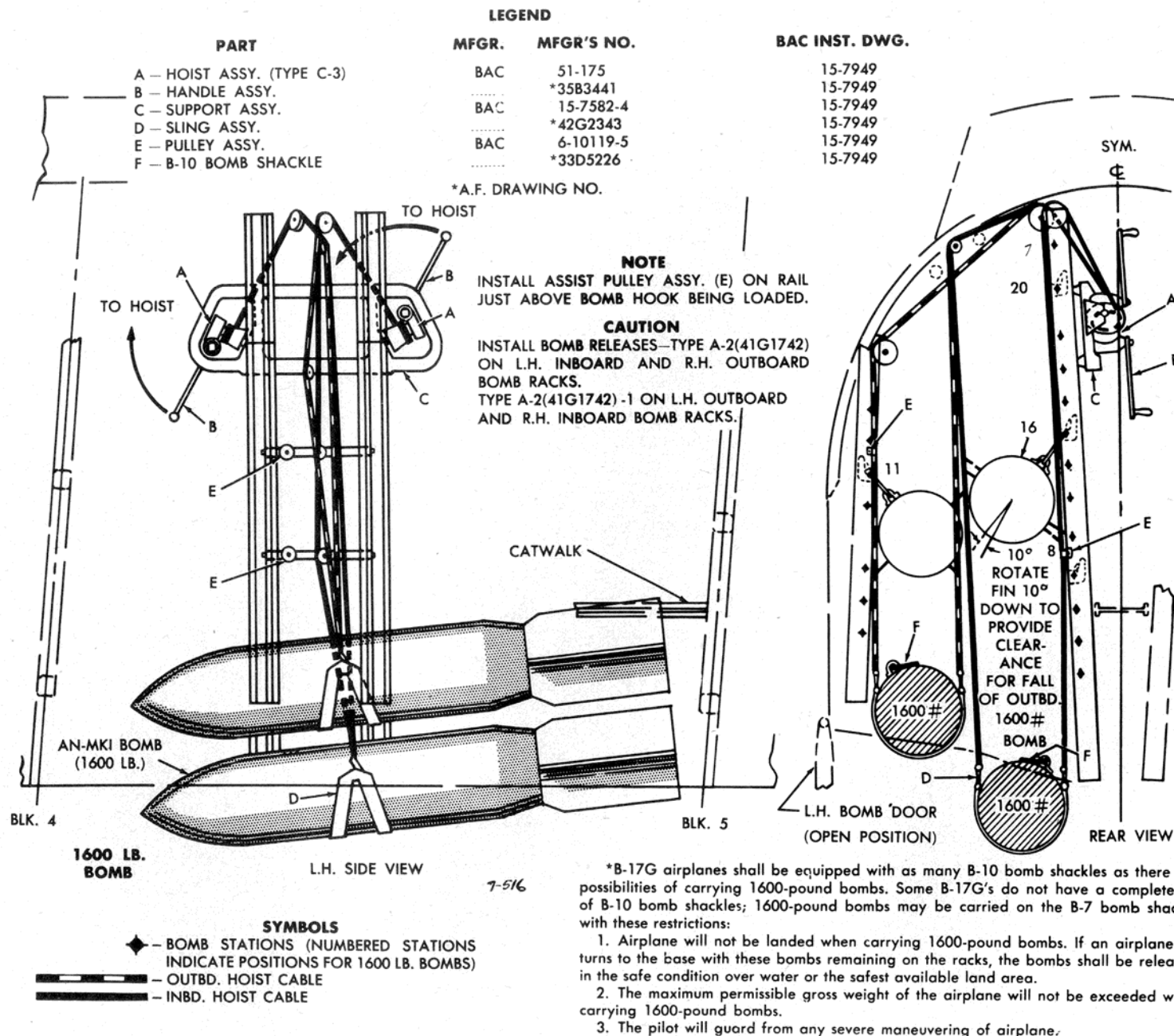
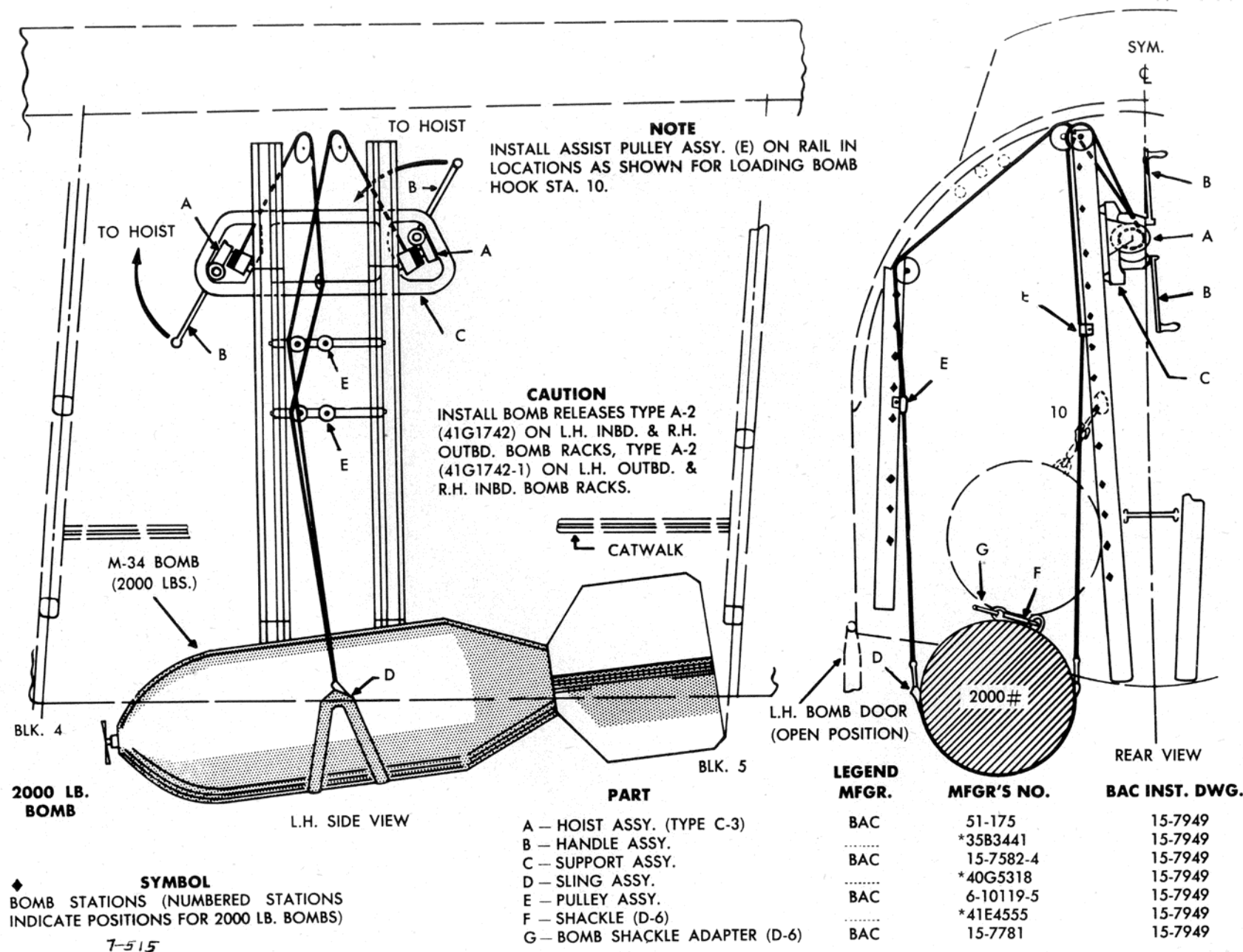


Figure 422—Bomb Hoisting Diagram—2000-lb. Bomb

RESTRICTED



RESTRICTED  
AN 01-20EG-2

Section V

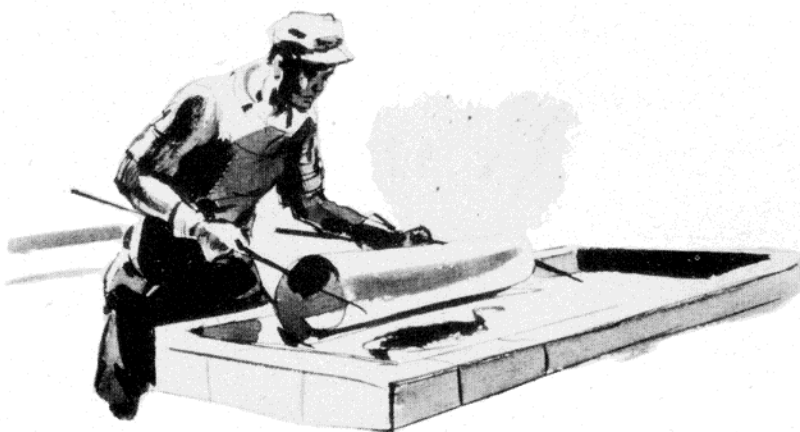
\*A.F. DRAWING NO.

Figure 423—Bomb Hoisting Diagram—1600-lb. Bomb



## SECTION II

### MATERIALS OF CONSTRUCTION



#### Note

Heat treatment of aluminum alloy parts is in accordance with Specification No. AN-QQ-H-186. Heat treatment of steel parts is in accordance with Specification No. AN-QQ-H-201. The following tabulation lists all heat-treated steel parts with SAE material designations and required heat treatment for structural parts in the fuselage, wings, nacelles and empennage. Refer also to the "Handbook of Structural Repair Instructions" for the B-17 Airplane (T. O. No. 01-20E-3).

#### LANDING GEAR PARTS

<i>Nomenclature</i>	<i>Dwg No.</i>	<i>Next Assy</i>	<i>Material</i>	<i>Heat Treatment</i>
Army Assy—Brake control	41-4543	64-1600	X4130	Normalize
Bearing Assy—Drag strut	46-6158	75-4805	X4340	150,000 to 170,000 lb/sq in.
Bracket Assy—Tail gear motor	55-7621	65-7331	X4130	80,000 to 120,000 lb/sq in.
Bracket—Landing gear motor support	3-12081	65-5299	X4130	Annealed
Brake Disc Assy—Tail	41-3727	6-9281	X4130	125,000 to 145,000 lb/sq in.
Clamp—Tail gear boot	1-18835	15-7440	1095 Stl	Spring temper
Forging Collar	6-6514	55-4803	X4130	150,000 to 170,000 lb/sq in.
Coupling Hand Crank	21-7028	15-7470	X4130	150,000 to 170,000 lb/sq in.
Disc Assy—Tail wheel brake	1-18077	6-9281	X4130	125,000 to 145,000 lb/sq in.
Disc Assy—Tail wheel brake	3-12988	6-9281	X4130	125,000 to 145,000 lb/sq in.
Drag Strut Assy—Landing gear	64-1491	65-4801	X4130	125,000 to 148,000 lb/sq in.
Forging—Tail gear fitting	3-12973	3-12974	X4130	80,000 to 120,000 lb/sq in.
Trunnion Landing Gear	41-2789	15-6429	X4130	150,000 to 170,000 lb/sq in.
Retainer—Retracting nut	53-7877	48-591	X4130	125,000 to 145,000 lb/sq in.
Ring—Tail wheel lock	3-13006	15-7470	Z2315 Stl	Normalize
Shaft—Retracting gear	81-2818	64-1498	X4130	150,000 to 170,000 lb/sq in.
Sleeve Assy—Tail wheel lock	41-3413	3-10080-1	X4130	Normalize
Spindle—Tail wheel	6-8959	15-7369	X4130	180,000 to 200,000 lb/sq in.
Stop Assy—Retracting screw lower	21-9840	64-1498	X4130	125,000 to 145,000 lb/sq in.
Stop Assy—Tail wheel retracting gear	21-6355	69-1787	X4130	150,000 to 170,000 lb/sq in.
Stop Inst—Landing wheel	6-8049	75-4805	1095 Stl	Spring temper
Terminal—Drag strut	46-5917	64-1491	X4130	Normalize
Terminal—Tail wheel lock	41-3415	3-10080	X4130	Normalize
Terminal—Tail wheel lock	41-9807	3-10080-2	X4130	Normalize
Universal—Drag strut	41-9800	65-4801	X4130	125,000 to 140,000 lb/sq in.
Cylinder—Wheel brake	3-10296	3-9584	X4130	75,000 to 120,000 lb/sq in.
Wrench—Landing gear oleo	41-1254	15-7311	X4130	125,000 to 150,000 lb/sq in.
Yoke—Tail gear	15-7378	15-7470	X4130	125,000 to 145,000 lb/sq in.

MISCELLANEOUS PARTS

<i>Nomenclature</i>	<i>Dwg No.</i>	<i>Next Assy</i>	<i>Material</i>	<i>Heat Treatment</i>
Angle—Auxiliary fuel tank	1-17577	59-227	X4130	95,000 to 120,000 lb/sq in.
Arm Assy—Brake control	41-4543	64-1600	X4130	Normalize
Arm Assy—Brake control	41-4544	64-1600	X4130	Normalize
Arm—Brake pedal	41-6558	46-7284	X4130	Normalize
Angle—Support	1-18955	55-6691	X4130	95,000 to 120,000 lb/sq in.
Bolt Assy—Self locking	3-6738	75-3686	X4130	125,000 to 145,000 lb/sq in.
Bolt—1/4-28 shoulder	21-6377	69-1787	2330 Stl	125,000 to 145,000 lb/sq in.
Bracket Assy—Bomb hoist				
3 1/2-in. pulley	41-9798	65-3469	X4130	75,000 to 120,000 lb/sq in.
Bracket—Hoist cable	1-21969	1-21968	X4130	95,000 to 120,000 lb/sq in.
Bracket Inst—Tail gear motor	15-7621	15-7331	X4130	80,000 to 120,000 lb/sq in.
Bracket—Rear gun sight	1-19658	15-7518	X4130	95,000 to 120,000 lb/sq in.
Cam Assy—Door release	44-765	44-764	X4130	150,000 to 170,000 lb/sq in.
Cam—Engine control lock	41-7906	41-9736	X4130	180,000 to 200,000 lb/sq in.
Cam—Throttle lock	41-9730	65-5690	1095 Stl	Spring temper
Spring (door release)—Catch	21-7328	3-11953	1095 Stl	Spring temper
Spring—Catch	21-7329	3-11953	1095 Stl	Spring temper
Channel—Bomb hoist	1-18438	15-7582	X4130	95,000 to 120,000 lb/sq in.
Check Inst—Bomb door	6-8345-3	65-4139	X4130	Normalize
Rod Assy—Bomb door check	51-872		X4130	90,000 to 120,000 lb/sq in.
Check Inst—Bomb door cylinder assy	6-8345	65-4139	X4130	Normalize
Check Inst—Bomb door pin	6-8345	65-4139	X4130	125,000 lb/sq in.
Check Inst—Bomb door spring				
expander	6-8345	65-4139	1095 Stl	Spring temper
Collar Assy—Bomb door control	3-9778	65-4127	X4130	Normalize
Cone—Jacking	41-8304	55-6185	X4130	125,000 to 145,000 lb/sq in.
Cone—Jacking	51-7	75-3441	X4130	150,000 to 170,000 lb/sq in.
Coupling Assy—LH thread control rod	1-19702	15-6991	X4130	65,000 to 85,000 lb/sq in.
Coupling—Hand crank	21-7028	15-7470	X4130	150,000 to 170,000 lb/sq in.
Crank—Shackle adapter	1-19843	1-19857	X4130	95,000 to 120,000 lb/sq in.
Driver—Coupling yoke	41-4234	15-7579	X4130	180,000 to 200,000 lb/sq in.
Fitting Assy—Jacking cone	41-9821	66-5878	X4130	150,000 to 170,000 lb/sq in.
Fitting—Auxiliary fuel tank	3-12994	59-2221	X4130	95,000 to 120,000 lb/sq in.
Fitting—Shackle adapter	51-276	15-7881	X4130	150,000 to 170,000 lb/sq in.
Guide Assy—Bomb hoist cable	3-9777	15-7335	X4130	125,000 lb/sq in.
Handle—Bomb sight clamp	41-833	3-11741	X4130	Normalize-min TS
				75,000 lb/sq in.
Handle—Filler cap	1-19667	3-13806	X4130	95,000 to 120,000 lb/sq in.
Hook—Ammunition box holder	1-18418	8-1197	X4130	Normalize
Hook—Strap end	1-17549	6-8963	X4130	180,000 to 200,000 lb/sq in.
Hook—Strap end	1-19845	3-13725	X4130	180,000 to 200,000 lb/sq in.
Retainer Interphone—Jack	41-158	6-7722	1095 Stl	Spring temper
Lever Assy—Shackle adapter	1-19069	15-7781	X4130	95,000 to 120,000 lb/sq in.
Link—Control cable	1-19652	15-7030	X4130	125,000 to 145,000 lb/sq in.
Lock Assy—Gun deflector	1-20050	6-9623	X4130	95,000 to 120,000 lb/sq in.
Lug—Tank support	1-18540	59-2222	X4130	125,000 to 145,000 lb/sq in.
Mast Assy—Antenna	6-9464	9-3644	X4130	95,000 to 120,000 lb/sq in.
Pin—Gun mount lock	1-16321	1-18452	X4130	125,000 to 145,000 lb/sq in.
Plate—Bomb hoist support	1-18311	15-7582	X4130	80,000 to 120,000 lb/sq in.
Plate—Bomb hoist support	1-18312	15-7582	X4130	80,000 to 120,000 lb/sq in.
Plate—Gun fire deflector	3-13458	15-7381	X4130	125,000 to 145,000 lb/sq in.
Plate—Gun fire deflector	3-13463	15-7381	X4130	125,000 to 145,000 lb/sq in.
Plate—Pilot's floor	3-13553	75-3513	X4130	75,000 to 120,000 lb/sq in.
Plunger Assy—Pilot's seat adjustment	21-5641	55-5272	X4130	95,000 to 120,000 lb/sq in.
Plunger—Carburetor air control	41-9114	3-11579	X4130	125,000 to 145,000 lb/sq in.
Ring Assy—Filler bonding	1-19098	15-7936	X4130	95,000 to 120,000 lb/sq in.
Ring Assy—Gun sight	3-13385	3-13482	X4130	80,000 to 120,000 lb/sq in.
Ring Assy—Gun sight cross bar	3-13385	3-13482	1112X Stl	80,000 to 120,000 lb/sq in.
Rod Assy—Bomb door check	51-872	6-8345	X4130	90,000 to 120,000 lb/sq in.
Rod Assy—Locking	3-12984	15-7337	X4130	65,000 to 85,000 lb/sq in.
Sector—Lock lever	41-7964	65-5690	X4130	125,000 lb/sq in.
Shaft—Adapter crank	1-19856	1-19857	X4130	65,000 to 85,000 lb/sq in.
Shaft Assy—Shackle adapter	1-19060	15-7781	X4130	95,000 to 120,000 lb/sq in.
Shaft—Throttle lock	41-4293	65-5690	X4130	120,000 to 145,000 lb/sq in.
Shaft—Throttle support	41-4286	65-5690	X4130	120,000 to 145,000 lb/sq in.
Spacer Assy—Shackle adapter	1-18982	15-7781	X4130	125,000 to 140,000 lb/sq in.
Spindle—Camera hatch latch	1-18448	1-18578	X1020 Stl	65,000 to 85,000 lb/sq in.
Spring—Air control	1-20036	9-3661	1095 Stl	Spring temper
Spring Assy—Warning switch	41-9179	1-16653	1095 Stl	Spring temper



## MISCELLANEOUS PARTS (Continued)

<i>Nomenclature</i>	<i>Dwg No.</i>	<i>Next Assy</i>	<i>Material</i>	<i>Heat Treatment</i>
Spring—Bomb hoist crank	41-75	65-4138	1095 Stl	Spring temper
Spring—Door pin	1-21943	46-9419	1095 Stl	Spring temper
Spring—Defroster control	1-17572	6-9481	1095 Stl	Spring temper
Spring—Retainer gun mount lock	1-18147	15-7008	X4130	125,000 to 145,000 lb/sq in.
Spring—Shield cover	1-18830	14-2079	1095 Stl	Spring temper
Spring—Spoiler	1-16379	15-6621	1095 Stl	Spring temper
Stop Assy—Attitude control	51-623	64-1740	X4130	125,000 to 145,000 lb/sq in.
Stop Assy—Flap motor	41-4600	46-6905	X4130	150,000 to 170,000 lb/sq in.
Stop Inst—Landing wheel	6-8049	75-4805	1095 Stl	Spring temper
Stop—Limit switch	1-18094	6-9209	X4130	95,000 to 120,000 lb/sq in.
Support Assy—Cowl	1-19076	15-7666	X4130	95,000 to 120,000 lb/sq in.
Support Assy—Cowl	3-13802	15-7668	X4130	95,000 to 120,000 lb/sq in.
Support Assy—Cowl	3-13803	15-7668	X4130	95,000 to 120,000 lb/sq in.
Support Assy—Rear gun	6-9589	9-3610	X4130	75,000 to 120,000 lb/sq in.
Support Assy—Rudder lock plunger	3-13625	15-7526	X4130	95,000 to 120,000 lb/sq in.
Support Inst—Starter crank	14-1820	15-7359	X4130	Normalize
Terminal—Bomb door controls	6-8130	65-4127	X4130	90,000 to 120,000 lb/sq in.
Terminal—Shackle adapter	3-13937	15-7781	X4130	125,000 to 140,000 lb/sq in.
Terminal—Tube end	41-8217	65-4101	X4130	125,000 to 145,000 lb/sq in.
Tube Assy—Rear gun support	3-13531	15-7518	X4130	125,000 to 145,000 lb/sq in.
Tube—Bomb rail spreader	1-17504	6-8956	X4130	95,000 lb/sq in.
Tube Shackle adapter	8-1295	15-7781	X4130	180,000 to 200,000 lb/sq in.
Universal—Bomb hoist	41-4188	65-3469	10080 Stl	170,000 to 190,000 lb/sq in.
Pulley Bracket Wrench—Generator	1-21026	15-7311	X4130 Stl	200,000 lb/sq in.
Yoke Assy—Rear gun mount	3-13527	15-7518	X4130	125,000 to 145,000 lb/sq in.
Zee—Bearing support	41-6600	9-2711	X4130	Normalize
Zee—Bearing support	41-6601	9-2711	X4130	Normalize



## SECTION III

### FINISH



#### 1. CLEANING AND INSPECTION.

##### a. CLEANING.

(1) GENERAL.—Cleaning should be accomplished by removing all foreign matter, without damage to the surface or the structure of the part, thus permitting accurate inspection and subsequent refinishing when necessary. Methods and cleaning materials to be used must be governed somewhat by individual circumstances, but there are definite precautions which must be observed. In general, aluminum or aluminum alloy must be handled with extreme care and any cleaning operation involving combinations of these materials with solvents or cleaners must be governed by the properties of the aluminum or aluminum alloy parts. The proper use of volatile solvents may be satisfactory, but it must be remembered that they are quickly contaminated. Care must be taken to prevent surface scratching with dirty solvent, and rinsing will be necessary after the use of the solvent.

(2) ALUMINUM AND ALUMINUM ALLOYS.—Primary precautions to be considered in connection with cleaning aluminum and aluminum alloys are as follows:

##### CAUTION

DO NOT USE ANY CAUSTIC SOLUTION OR COMPOUND. DO NOT USE CARBON TETRACHLORIDE WHERE IT CAN TOUCH NEOPRENE OR ANY OTHER SYNTHETIC RUBBER THAT IS IN CONTACT WITH ALUMINUM OR ALUMINUM ALLOYS.

(a) Where rubber matting is cemented to aluminum or aluminum alloy, use alcohol sparingly or soap and warm water followed by thorough rinsing.

(b) Degreasing compounds may be used if care is taken to complete removal of the compound in the subsequent flushing or rinsing operations.

(c) Riveted assemblies with no finish other than anodizing may be cleaned with any non-caustic aqueous solution or any volatile solvent except carbon tetrachloride, as noted previously.

(d) Steam vapor cleaning may be used except where assemblies contain rubber, micarta, fiber, wood, or fabric.

(3) STEEL, BRONZE, AND BRASS.—Cleaning of steel, bronze, or brass parts may be accomplished in almost any convenient manner except that brass and bronze should not be allowed to remain any longer than necessary in strong caustic solutions, and thorough rinsing and drying are essential. Cadmium-plated parts may be cleaned in a like manner, except that abrasive action on the cadmium plating should be avoided. Gears, housings, and retracting screws may be cleaned in solvents but must be thoroughly rinsed with hot water or steam vapor before satisfactory inspection can be made. Control cables should be cleaned only by wiping lightly with a dry cloth when necessary, *unless* material and equipment are available for reapplication of the rust-preventive treatment. Refer to section IV, paragraph 7. *b*. Prelubricated, sealed bearings should not be cleaned in any manner except by light surface wiping with a cloth, dampened with solvent if desired.

##### (4) FABRICS.

(a) The doped fabric skin of the control surfaces may be cleaned with soap and warm water or with degreasing solutions, but must not be immersed in liquids. Light rinsing with steam vapor should be satis-



factory if the nozzle is held sufficiently far away from the fabric to prevent excessive heat.

(b) Interior fabrics should be vacuum cleaned and sponged with soap and water, or solvent if required, without soaking the fabric.

(5) WINDOWS.

(a) In washing plastic windows, care must be taken not to rub hard particles of sand or grit into the surface. The surface may be washed with a soft cloth. If the plastic windows become soiled with grease or oil, use kerosene or naphtha applied with a soft cloth. Solvents for plastics, such as esters, ketones, aromatic hydrocarbons, or chlorinated hydrocarbons, must *never* be used as cleaners.

(b) Minor scratches may be removed, after washing, by rubbing carefully with an extremely fine abrasive cleaner (AAF Specification 20014). Rub the scratched area only and remove the cleaner with a damp cloth. Repeat as often as necessary to produce clear vision. For deep scratches, prepare for rubbing with the cleaner by sanding the scratched area with No. 400 "wet or dry" sandpaper.

(c) A protective finish may be given the plastic window by applying hard wax polish thoroughly and evenly. Rub lightly to avoid overheating the surface (which would permit plastic to flow into ridges and result in distorted vision).

b. THREAD LUBRICATION.—Thread lubricant should be used at all pipe fittings and at all Parker triple type tube fittings to improve the seal and to prevent seizing of threads or other surfaces in contact. Lubricate the male threads only, and in a manner which prevents any entrance of the lubricant into the tube or fitting. At tubing sleeves apply the lubricant to the inside of the sleeve and to the outside of the sleeve shoulder.

(1) Lead soap base lubricating grease, U. S. Army Specification 2-118, should be applied at all fittings except in oxygen equipment or where temperatures will exceed 82°C (180°F). Male pipe threads on fuel and oil lines must be carefully tinned, and grease, Specification AN-G-14, applied sparingly on the tinned threads at assembly.

(2) Apply anti-seize compound, Specification AN-VV-C-566, or equivalent, to all fittings, where temperatures will exceed 82°C (180°F). This is also recommended for use on the male threads of high temperature bolted connections for use such as exhaust flanges, rocker boxes, etc.

(3) Anti-seize and sealing compound, Specification AN-C-86, should be used as on threads in the oxygen system.

c. COLOR IDENTIFICATION.

(1) TUBING.—Identifying bands are applied near each end of a tube and near each flexible joint and union. The bands are colored gummed paper tape 1/2 inch

wide and are coated with clear lacquer after applying. Following are the tube-identifying colors used:

(a) FUEL SYSTEM.

Fuel lines	Red
Compensating pressure lines, fuel pump to carburetor	Light Blue, Light Green
Vapor removal lines	Red

(b) OIL SYSTEM.

Engine lubrication lines	Yellow
Oil dilution lines	Red
Propeller feathering lines	Blue, Yellow, Blue

(c) TURBO SUPERCHARGER  
LUBRICATION SYSTEM.

All lines	Yellow
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(d) HYDRAULIC SYSTEM.

All lines	Light Blue, Yellow, Light Blue
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(e) GLYCOL SYSTEM (airplane heat)

All lines	White, Black, White
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(f) DEICER AND VACUUM SYSTEM.

Suction lines	White, Light Green
Pressure lines	Light Blue, Light Green
Oil drain lines	Yellow

(g) PITOT-STATIC SYSTEM.

Pitot pressure lines	Black
Static pressure lines	Black, Light Green

(h) PROPELLER ANTI-ICER SYSTEM.

All lines	White
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(i) ENGINE FIRE EXTINGUISHER SYSTEM.

All lines	Brown
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(j) OXYGEN SYSTEM.

Distribution lines	Light Green
Filler lines	Light Green, Yellow, Light Green

(k) MANIFOLD PRESSURE LINES.

All lines	White, Light Blue
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(2) CABLES.—Identifying bands are applied near the ends of each individual cable assembly. These bands are colored adhesive cellophane tape 1/4 inch wide and are coated with clear lacquer after applying. The following are the cable-identifying colors used:

(a) FLIGHT CONTROLS.

Aileron—left up and right down	White
Aileron—left down and right up	White, Black
Aileron trim tab—up	White
Aileron trim tab—down	White, Black
Rudder—right	Light Green
Rudder—left	Light Green, Black



Rudder trim tab—right	Light Green
Rudder trim tab—left	Light Green, Black
Elevator—up	Yellow
Elevator—down	Yellow, Black
Elevator Trim tab—up	Yellow
Elevator trim tab—down	Yellow, Black
Empennage—lock	Red
Empennage—unlock	Red, Black
Tail wheel—lock and release	Light Blue

(b) ENGINE CONTROLS.

Carburetor air—cold	White, Brown, White
Carburetor air—hot	White, Red, White
Mixture—auto rich	Brown
Mixture—fuel cut-off	Brown, Black
Throttle—open	Black, Black
Throttle—closed	Black, Black, Red

(c) MISCELLANEOUS CONTROLS.

Fire Extinguisher	Black, Brown, Red
Propeller feathering	Light Blue, Yellow, Light Blue

2. REFINISHING.

a. GENERAL.—All interior, exterior, and detail finishing must be in accordance with Boeing finish Specification No. D-2304, which consolidates the general U. S. Army Specification No. 3-100-H with the Boeing B-17G airplane Detail Specification No. D-2163-G. The following summary shall be used as a guide only, and reference should always be made to the specification for final authority.

(1) All interior and exterior parts fabricated from steel, except corrosion-resistant steel and armor plate, shall be cadmium plated only.

(2) Spring shall *not* be cadmium plated.

(3) All interior and exterior parts fabricated from aluminum alloys shall be anodized only except those from the following alloys: 24ST ALCLAD ALUMINUM ALLOY; 17ST ALCLAD ALUMINUM ALLOY; 3S ALUMINUM ALLOY; 52S ALUMINUM ALLOY; and 2S ALUMINUM.

(4) Aluminum alloy parts may be anodized after assembly.

(5) The interior surface of the wings, stabilizer, fin, nacelles, body, and those surfaces behind the sound-proofing and control surfaces shall not be painted regardless of the material used, except as follows:

(a) The interior exposed metal surfaces in the control cabin shall be finished with one coat of primer and one coat of dark green lacquer after installation.

(b) The interior surfaces of fabric-covered control surfaces only shall be finished with one coat of primer and one coat of carbon black tinted primer after the structure is as complete as possible.

(6) Seats, tables, and other such items need not be painted, except as noted in paragraph (12).

(7) The surfaces between outer skin of the wings and the corrugation panels shall not be painted.

(8) All surfaces inside the wing in the vicinity of the fuel tanks shall be sprayed with two coats of zinc chromate primer as a spark inhibitor.

(9) Air ducts and parts attached to air ducts shall not be anodized nor painted inside or outside.

(10) The interior surfaces of the chords of the wing spars, the interior surfaces of the body bulkhead chord members at stations 4 and 5, and of the diagonal bulkhead members between the chords at station 4 and station 5 shall be coated with P-27 primer after the riveting is complete.

(11) The surfaces between the corrugation and the outer sheet of the floors shall not be painted.

(12) The top surface of wood tables in the navigator's compartment shall be finished as follows:

Surfacer—1 coat (Fuller's No. 1705 or equivalent)

Dark green lacquer—2 coats

(13) Cables shall be dipped in hot 71°C (160°F) heavy rust preventive compound, Specification No. AN-C-52.

(14) Interior surfaces of cowling shall not be painted.

(15) No paint coating shall be applied to either side of the fire wall, or to parts and surfaces of the engine section forward of the fire wall.

(16) Aluminum alloy parts attached directly to fire wall sheet shall be anodized only. Steel parts, other than corrosion-resistant steel, attached directly to fire wall sheet shall be cadmium plated only. Additional insulation, between dissimilar metals of fire wall and parts attached thereto, shall not be required.

(17) Rubber and rubber-like surface shall not be painted or greased.

(18) The outer seams of the fuselage covering shall be sealed with liquid sealing compound (zinc chromate compound).

(19) The surfaces in contact and faying surfaces of cadmium plated steel parts and cadmium plated copper alloys with aluminum, Alclad or anodized aluminum alloys shall be assembled without paint. The surfaces in contact and the faying surfaces of anodized aluminum alloy, aluminum, and Alclad, in any combination, may be assembled without paint.

b. FINISH SPECIFICATION.—This specification covers the methods and materials required in the preparation for, and application of, protective coatings for aircraft parts and surfaces and includes U. S. Army Specification No. 3-100-H, "General Specification for Protective Coatings and Finishes for Aircraft and Air-



**Section VII**  
**Paragraph 2**

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craft Parts," and exceptions in accordance with B-17G Detail Specification No. D-2163-G.

(1) **APPLICABLE SPECIFICATIONS.**—The current issue of the following Specifications forms part of this Specification:

U. S. Army	98-24113	Color for Army Air Forces airplanes
U. S. Army	98-24100	Doping aircraft surfaces
	AN-M-12	Chromate treatment for magnesium base alloys (for aircraft)
U. S. Army	98-20007	Cleaning of aircraft metal surfaces prior to application of initial protective coating
	AN-QQ-P-421	Cadmium plating (for aircraft parts)
	AN-QQ-A-696	Protective coating for aluminum and aluminum alloys (anodic process)
Federal	QQ-A-361	Aluminum alloy sheet, aluminum covered
Federal	QQ-A-561	Aluminum; Plates and sheets
	AN-R-T-541	Toluene
U. S. Army	57-0-2	High-grade rustproofing (iron and steel)
	AN-RR-C-48	Cable; Steel, corrosion resistant extra-flexible
	AN-RR-C-43	Cable; 7 x 19 Steel, extra flexible
	AN-T-20	Tie Rods; Streamline
	AN-TT-L-51	Lacquer, Cellulose nitrate
	AN-TT-T-256	Thinner (for cellulose nitrate dopes and lacquers)
U. S. Army	3-107	Paint, Dope-proof
	AN-E-3	Enamel for aircraft
	AN-C-52	Compound, Rust-preventive, heavy
Federal	TT-A-468	Aluminum pigment, (powder and paste)
Federal	QQ-A-359	Aluminum-Alloy (aluminum manganese) plates and sheets
Federal	QQ-A-318	Aluminum-Alloy (AL-52) (aluminum-magnesium-chromium) plates, sheets and strips
Federal	TT-V-121	Varnish; Spar, water-resisting
Federal	TT-V-91	Varnish; Shellac
	AN-TT-D-551	Dope, Nitrate; Clear (for aluminum dope)
	AN-TT-V-118	Varnish, Spar and seam compound
	AN-TT-P-656	Primer, Metal; zinc chromate
	AN-P-31	Paint, Bituminous, coal tar pitch base, (blended type)

AN-QQ-S-772 Steel; Sheet or strip (18 chrome, 8 nickel, corrosion-resistant, cold rolled)

Federal QQ-A-362 Aluminum-Alloy, sheet and plate, aluminum-covered (aluminum-copper 1.5 magnesium-manganese)

AN-VV-O-366 Fluid, Hydraulic (petroleum base)

(2) **MATERIALS AND WORKMANSHIP.**

(a) **ALUMINUM PAINT COATINGS.**

1. The following table gives the recommended quantities of aluminum powder, or paste, conforming to Federal Specification No. TT-A-468, to be used where aluminum pigmented paint coatings are specified. The quantities are based on one gallon of package material before reduction.

	<i>Powder, Type B</i>	<i>Paste, Type B</i>
Spar varnish	1 lb.	1.5 lb.
Clear nitrate dope	8 oz.	1.0 lb.
Clear lacquer	10 oz.	1.0 lb.
Bituminous paint	1.55 lb.	2.0 lb.
Iron oxide primer	1 lb.	1.5 lb.
Zinc chromate primer	6 oz.	8.0 oz.

2. Wherever carbon black tinted primer is specified, it shall consist of, or be equivalent to, eight ounces of carbon black tinting paste (Fuller's No. SP 790 or equivalent) per gallon of zinc chromate primer.

(b) **CLEAR PRIMER FOR ALUMINUM COATED (ALCLAD) ALUMINUM ALLOYS.**—A clear varnish type coating, such as material conforming to Federal Specification No. TT-V-121, may be used as a shop coating to prevent scratching of the sheets during fabrication. This coating or additional coats, if necessary, may be used as the primer coat on interior surfaces.

(c) **GREEN FINISH.**—The dark green lacquer for the control cabin, radio compartment, except camera compartment, and the bombardier and navigator's compartment shall be duPont Duco No. 258-38154, Berry Bros. Berryloid bronze green lacquer No. 234G9, or the equivalent.

(d) **EXTERIOR METAL SURFACES.**—The external metal surfaces of the airplane shall consist of material which, as specified in AAF Specification No. 3-100-H, do not require an additional organic protective coating.

(3) **GENERAL REQUIREMENTS.**

(a) **CLEANING.**

1. All surfaces shall be cleaned in accordance with U. S. Army Specification No. 98-20007 and shall be dry at the time of application of any paint-type protective coating.

2. Corrosion resistant steel parts which have become scaled or rusted shall be pickled in a bath of

hydrochloric or sulphuric acid base, after which they shall be passivated by immersing in a solution containing 15 percent by weight of nitric acid, at approximately room temperature, for 20 minutes. Rinse thoroughly in hot water.

(b) APPLICATION OF PAINT COATING.—The initial paint coating shall be applied immediately after cleaning, plating, or chemical treatment, except surfaces of which one side is finished with bituminous paint and opposite side with primer. The bituminous coating shall not be applied until after assembly to avoid bleeding of the paint through rivet holes onto the surface which receives the primer.

(c) THINNERS.—Thinners used for the reduction of dopes and/or lacquers shall conform to Specification No. AN-TT-T-256 or shall be a product recommended by the manufacturer for the particular lacquer and/or dope.

#### (4) DETAIL REQUIREMENTS.

(a) CADMIUM PLATING.—All steel parts and brass, bronze, or copper parts in contact with other metals or with wood, shall be cadmium plated in accordance with Specification No. AN-QQ-P-421, unless otherwise specified and except as noted below:

1. Parts manufactured of corrosion-resistant or stainless steel.
2. Welded structures, which are too large for plating equipment available.
3. Parts which are welded to unplated structures, such as cowling supports and steps.
4. Cable and zinc coated or tinned wire.
5. Members or portions of members which act as bearings or journals.
6. Welded tubular parts, such as engine mounts, etc., which are difficult to drain thoroughly, shall not be pickled or plated. They shall be sand blasted and given one coat of primer and one coat of carbon black tinted primer.
7. Steel gears, retracting screws, and internal parts of air-oil shock strut assemblies shall not be cadmium plated.
8. Drilled holes, reamed holes, and press fit surfaces need not be cadmium plated.
9. All interior and exterior parts fabricated from steel, except parts fabricated from corrosion resistant steel, shall be cadmium plated only.
10. Armor plate shall not be cadmium plated.
11. Springs shall not be cadmium plated.
12. Universal joints shall be cadmium plated as required by Specification No. 40236-B, except plating may be omitted on Apex universal joints 2700-16 and 2700-20, on the drive rings 2700-16-2, 2700-20-2, and from the outer surfaces of the yoke forks 2700-16-1 and 2700-20-1.

(b) TIN PLATING.—A plating of tin may be used in place of cadmium on parts which are subsequently soldered.

(c) RUST-PROOFING.—When rust-proofing is specified, the finish shall conform to Specification No. 57-0-2.

(d) ANODIC TREATMENT.—The following aluminum, aluminum alloy, and aluminum coated alloy parts shall be anodically treated in accordance with Specification No. AN-QQ-A-696, unless otherwise specified. In order to obtain maximum protection from the anodic coating, as much forming, drilling, and cutting shall be performed on the parts prior to treatment as is practicable. With the exception of parts assembled by welding and parts which are not under stress, all parts shall be treated in detail before assembly.

1. All fuel and oil tanks and lines, except those manufactured from alloys conforming to Federal Specification No. QQ-A-362 or No. QQ-A-361 (Alclad) and No. QQ-A-318 (AL-52). Alkaline dichromate processes accepted under U. S. Army Specification No. 98-20007 may be used in place of anodic treatment. Tank shells shall not be anodized. Interior parts made from 2S and 3S aluminum alloy shall not be anodized or painted.

2. All castings, forgings, and extrusions, unless the alloy is unsuitable for anodization. Anodic treatment cannot be satisfactorily employed on die, sand, or permanent mold castings containing non-aluminum metal inserts. The steel, brass, or bronze inserts in such castings shall be cadmium plated before insertion in mold. In place of anodic treatment the finished casting shall, after cleaning and prior to painting, be immersed for two to three minutes in a five percent (by weight) solution of chromic acid at 60°C to 71°C (140°F to 160°F).

3. All interior and exterior parts and surfaces, except those fabricated from the following alloys:

Federal Specification No. QQ-A-362

—Aluminum-coated aluminum alloy (24ST Alclad)

Federal Specification No. QQ-A-361

—Aluminum-coated aluminum alloy (17ST Alclad)

Federal Specification No. QQ-A-359

—Aluminum alloy (3S)

Federal Specification No. QQ-A-561—Aluminum (2S)

Federal Specification No. QQ-A-318

—Aluminum alloy (AL-52)

When parts or surfaces fabricated from the above alloys form exterior surfaces on which paint coatings other than insignia or markings are required, they shall be surface treated by one of the following methods to obtain maximum paint adhesion:

a. Anodically treated in accordance with Specification No. AN-QQ-A-696.

b. Treated by one of the following methods described in U. S. Army Specification No. 98-20007.



(1) Alkaline cleaning compound—Chromic acid.

(2) Alcoholic phosphoric acid cleaner.

4. Electric conduit, conduit clamps, junction boxes, and all plumbing shall not be anodized or painted.

5. "Alrok" chemical treatment for aluminum alloys (Aluminum Company of America process) may be used interchangeably with anodic treatment.

6. Aluminum alloy parts may be anodized after assembly.

7. The top surface of the catwalk in the bomb bay shall be anodized only and shall not be painted.

8. Aluminum alloy bolt and rivet spacers shall not be anodized or painted.

9. All aluminum alloy extruded shapes, tubing and non-Alclad sheets may be anodized when in stock form, with the exception of material used for hammer forming. Parts made from anodized stock shall not require further anodizing.

10. All interior and exterior parts fabricated from aluminum alloys shall be anodized only, except those from the following alloys: 24ST ALCLAD ALUMINUM ALLOY, 17ST ALCLAD ALUMINUM ALLOY, 3S ALUMINUM ALLOY, 2S ALUMINUM, and 52S ALUMINUM ALLOY.

11. Anodic treatment may be eliminated, provided an organic protective finish is substituted.

(e) CHROMATE TREATMENT.—All magnesium and magnesium base alloy parts and surfaces shall be treated in accordance with Specification AN-M-12.

1. Magnesium and magnesium alloy parts shall be treated with the alkaline-dichromate treatment in cases where such treatment is to be applied after machining operations, and where close tolerances are to be maintained.

2. Parts shall be cleaned with an alkaline cleaner or by boiling for five minutes in a solution containing two percent by weight of sodium hydroxide. Then rinse thoroughly in hot water.

3. After rinsing, the parts shall be immersed from 20 to 60 minutes, or until the parts are dark gray or black, in a boiling solution of:

Ammonium sulphate	4 ounces
Sodium dichromate	4 ounces
Ammonia (sp gr 0.880)	1/3 fluid ounce
Water	To make 1 gallon

4. Following the alkaline-dichromate treatment, the parts shall be washed immediately in cold running water and rinsed in hot water to facilitate drying.

(f) DOPE-PROOFING.—Parts in contact with doped fabric and assemblies which are covered with doped fabric shall be finished after assembly as follows:

Zinc chromate primer—One coat

Carbon black tinter primer—One coat

(g) GREASING.

1. Threads on adjustable parts which are disconnected or disassembled shall be greased before assembly.

2. Ferrous parts which are not to be cadmium plated or otherwise finished because of their bearing surfaces, shall be coated with rust preventive compound, Specification No. AN-C-52.

(h) OPEN ENDED TUBULAR AND HOLLOW PARTS.—The interior surfaces of all hollow and tubular parts, or members which are open ended, shall be given a coat of an approved primer conforming to Specification No. AN-TT-P-656. The coating shall be applied by filling and draining or by dipping.

(i) CLOSED OR SEALED METAL TUBULAR AND HOLLOW PARTS.

1. The interior surfaces of all closed or sealed steel parts or members, and of parts which are plated and which contain crevices or pockets where the plating solution might be held, shall be protected by coating of raw linseed oil, or an approved rust preventive compound conforming to U. S. Army Specification No. 2-82. The liquid shall be applied by forcing it into the hollow members under pressure, or by immersing the part in a bath of the liquid. The liquid shall be at a temperature of not less than 71°C (160°F) during application, and shall be allowed to remain on the surface for at least two minutes. In case of a large structure, interconnecting holes may be drilled between the various members so that the liquid will circulate.

2. The presence of the liquid in each member may be checked by noting the increase in temperature. Parts which are immersed shall be manipulated so as to insure the absence of air pockets, and shall remain in the bath until all bubbling has ceased. The members shall be thoroughly drained after treatment, and wiped free from oil on all exterior surfaces. All accessible holes drilled in the members shall be closed with cadmium-plated Parker self-tapping screws or equivalent. Solder shall not be used to close the holes. No protective coating is required on the interior surfaces of closed aluminum alloy members.

(j) FINISH FOR INTERIOR PARTS AND SURFACES.

1. The interior surfaces of the wings, stabilizer, fin, nacelles, body, those surfaces of the body behind the soundproofing, and control surfaces, shall not be painted regardless of the material used, except as follows:

a. The interior exposed metal surfaces in the control cabin shall be finished with one coat of



primer and one coat of dark green lacquer, (duPont No. 258-38154, or Berry Bros. Berryloid Bronze Green Lacquer No. 234G9 or the equivalent), applied after installation.

b. The interior surfaces of fabric covered control surfaces only, shall be finished with one coat of primer and one coat of carbon black tinted primer, after the structure is as complete as possible.

c. Seats, tables and other like items need not be painted, except as noted in paragraph (4) (l).

2. All instrument boards shall be finished with one coat of full black lacquer (duPont Duco No. 258-2801, or equivalent).

3. The surfaces between the outer skin of the wings and the corrugation panels shall not be painted.

4. Zinc chromate primer (Specification No. AN-TT-P-656) used wherever primer is specified.

5. A spark inhibiting finish of two coats of zinc chromate primer shall be given all surfaces inside the wing in the vicinity of the fuel tanks. The area to be finished shall extend from rib stations 1 to 13 inclusive, 12 inches forward of the front spar and 12 inches aft of the rear spar. This area shall not be masked off for painting purposes. The exterior surfaces only of metallic fuel tank shells shall be given two coats of zinc chromate primer.

6. Bolts, screws, and rivets shall not be painted prior to installation. Steel bolts, screws, and rivets shall be cadmium plated only. Aluminum alloy bolts, screws, and rivets shall be anodized only.

7. Air ducts shall be finished as follows:

a. All hot and cold air ducts which are part of the heating and ventilating system, or which are a part of the engine air intake system and intercooler system, shall not be anodized or painted inside or outside.

b. Parts which are attached to the air ducts need not be anodized or painted.

8. The inside surface of electrical conduit shall not be coated.

9. Bomb rack parts shall not be painted.

10. Rivet heads on unfinished or primed surfaces, or on surfaces which are finished before riveting, shall not be touched up except as follows: The interior surfaces of the chords of the wing spars, the interior surfaces of the body bulkhead chord members at stations 4 and 5, and of the diagonal bulkhead members between the chords at stations 4 and 5, shall be coated with P-27 primer, after the riveting is complete.

11. The surfaces between the corrugation and the outer sheet of the floors shall not be painted.

12. Clear varnish (Federal Specification No. TT-V-121) may be used as the primer coat for interior surfaces fabricated from aluminum-coated aluminum alloy (Alclad) sheets. On assembly, the interior finish

for such surfaces shall be completed by applying top coats in accordance with paragraph (j) 1. above.

(k) FINISH FOR EXTERIOR PARTS AND SURFACES.

1. Anti-glare coating, one coat of metal primer followed by one or more coats of flat bronze green lacquer or enamel, shall be applied to eliminate glare on such surfaces, as the fuselage deck, forward of pilots' compartment, and the inboard side of the engine nacelles, as required.

2. Cocardes shall be applied in accordance with paragraph E-3 of AAF Specification No. 24114.

(l) FINISH FOR WOOD SURFACES.

1. All interior wood surfaces shall be finished to match adjacent surfaces except as follows:

a. All wood doors and floors, the top surface of the wood tables in the navigator's compartment, and all wood surfaces adjacent to unpainted structure shall be finished with two coats of clear lacquer.

(m) FINISH OF CABLES AND WIRES.

1. Control cables shall not be painted. Corrosion resistant steel cables conforming to Specification AN-RR-C-48 may be given a light coat of oil or grease for lubrication. Steel cable conforming to Specification AN-RR-C-43 shall be coated with rust-preventive compound conforming to Specification AN-C-52, or with white lead and tallow.

2. Cables shall be dipped in hot, 71°C (160°F), heavy rust preventive compound, Specification AN-C-52.

3. Steel cable links shall be cadmium plated only and not painted.

4. Bronze and cadmium plated steel springs need not be painted unless specifically required.

(n) ENGINE COMPARTMENT.

1. The interior surfaces of cowling shall not be painted.

2. No paint coating shall be applied to either side of the fire wall.

3. No paint coating shall be applied to parts and surfaces of the engine section forward of the fire wall.

4. Exhaust stacks made of Inconel shall be sandblasted after welding.

5. Parts attached to the firewall shall be finished as follows:

a. Aluminum alloy parts attached directly to the firewall sheet shall be anodized only.

b. Steel parts, other than corrosion resistant steel parts, attached directly to the firewall sheet, shall be cadmium plated only.

c. Additional insulation, between dissimilar



metals of firewall and parts attached thereto, shall not be required.

(o) RUBBER.—Rubber and rubber-like surfaces shall not be painted or greased unless specified.

(p) WRAPPING AND SUPPORTS.

1. Supports for gasoline and oil tanks shall consist of felt impregnated with varnish, Specification No. AN-TT-V-118, or other water-resistant materials, or a fabric impregnated with the above materials in which the felt is encased.

2. Friction tape may be used for miscellaneous wrapping.

3. Rawhide or untreated fabric shall not be used as a wrapping material.

4. The wrapping of structural members to facilitate fastening of fabric coverings tends to promote corrosion and shall be eliminated whenever practicable. Lower longerons and lower cross-members shall not be wrapped.

5. The tank supporting cradles and straps shall be padded with a neoprene and cork composition, AAF Specification No. 12023.

(q) JOINTS AND SEAMS.—With the exceptions noted herein, the overlapping portions (surfaces in contact) of all-metal joints and seams, shall receive two coats of finishing material. The second coat may be either an additional coat of metal primer or a coat of aluminum varnish or lacquer. Bituminous paint may be used for both coats on joints and seams of parts and surfaces where the finishing scheme consists of aluminized bituminous paint. With any of the above finishes, the second coat may be wet or dry when the assembly is completed. Exceptions:

1. All parts joined by welding, brazing, or soldering.

2. Aluminum and aluminum alloy parts which are anodized after assembly.

3. Steel and brass parts which are cadmium plated after assembly.

4. Contact parts of attachment fittings which act as connections between the various units of the airplane, such as attachment of wings to the fuselage engine control brackets, and other accessories.

5. Terminals for electrical, radio, or bonding connections.

6. Zinc chromate weathertight sealing compound, or equivalent, shall be placed in all the outer seams of the fuselage covering to provide waterproofing.

7. The surfaces in contact with the faying surfaces of anodized aluminum alloy, aluminum, and Alclad, in any combination, may be assembled without paint.

8. The surfaces in contact and faying surfaces of cadmium plated steel parts and copper alloys with

aluminum, Alclad or anodized aluminum alloys shall be assembled without paint.

(r) WEARING SURFACES, OIL HOLES, ETC.—Care should be exercised to prevent the application of paint materials to wearing surfaces, threads and oil holes.

(s) DISSIMILAR METALS.—Dissimilar metal contacts, especially those between aluminum alloys and the alloys of copper or nickel, shall be avoided wherever practicable. Copper alloys and steel parts in contact with aluminum alloys shall be cadmium plated and then insulated in accordance with the requirements of paragraph (q) above.

1. Corrosion-resistant steel parts in contact with aluminum or aluminum alloy shall not be cadmium plated or insulated with friction tape or wet primer. The contact surface of the corrosion-resistant steel part shall not be coated with primer.

2. Bomb rack parts made of corrosion-resistant steel and which are in contact with aluminum or aluminum alloy shall not be cadmium plated or insulated with friction tape or wet primer. The corrosion-resistant steel parts shall not be coated with primer.

(t) HYDRAULIC SYSTEMS.—No protective coating is required on the internal surface of the hydraulic mechanisms operating in hydraulic fluid, Specification AN-W-0-366, which are at all times immersed in the oil. Such parts, when not installed and immersed in the fluid, shall be coated with rust preventive compound, Specification AN-C-52, and wrapped in heavy paper.

c. FINISH CODE NUMBERS.—The finish required is indicated on the drawing by code number. This code number consists of BF3 followed by one of the following dash numbers, (such as BF3-15):

15. Anodize.

17. Anodize.  
Primer—One coat.

20. Anodize.  
Primer—One coat.  
Lacquer—Dull black—one coat (Duco No. 258-2801, or equivalent).

21. Anodize.  
Primer—One coat.  
Lacquer—Dark green—one coat (Duco No. 258-38154, or equivalent).

35. Cadmium plate.  
37. Cadmium plate.  
Primer—One coat.

38. Primer—One coat.

41. Flat springs, steel.  
Acid bath, one minute. Cyanide bath, dip only.  
Cadmium plate.  
Bake after plating, five hours at 204°C (400°F).

42. Sandblast.
43. Sandblast (do not pickle).  
Primer—One coat.
44. Corrosion resistant steel parts which have been welded, annealed, etc. Immerse in a solution containing 50 percent by weight of hydrochloric acid at 54° – 60°C (130° – 140°F). Rinse in hot water.  
Passivate by immersing in a solution containing 15 percent by weight of nitric acid at approximately room temperature for 20 minutes. Rinse thoroughly in hot water.
45. Cadmium plate.  
Primer—One coat.  
Lacquer—Dull black—one coat (Duco No. 258-2801, or equivalent).
46. Coat the inside of closed hollow ferrous parts with raw linseed oil in accordance with U. S. Army Specification No. 3-100, paragraph E-9.
47. Cadmium plate.  
Primer—One coat.  
Lacquer—Dark green—one coat (Duco No. 258-38154, or equivalent).
48. Clean, coat with rust preventive compound, U. S. Army Specification No. 2-82.
49. Sun resisting rubber paint—Two coats (Goodrich No. 02-TK-132, or equivalent).
54. Cadmium plate—Ferrous parts.  
Anodize—Aluminum alloy parts.  
Primer—One coat.
55. Cadmium plate—Ferrous parts.  
Anodize—Aluminum alloy parts.
57. Cadmium plate—Ferrous parts.  
Anodize—Aluminum alloy parts.  
Primer—One coat.  
Lacquer—Dull black—one coat (Duco No. 258-2801, or equivalent).
58. Cadmium plate—Ferrous parts.  
Anodize—Aluminum alloy parts.  
Primer—One coat.  
Lacquer—Dark green—one coat (Duco No. 258-38154, or equivalent).
67. Primer—Two coats.
68. Primer coating inside of tubes, etc.
70. Acidproof paint—One coat (Federal Specification No. TT-V-51 grade B).
72. Acidproof paint—Two coats (Federal Specification No. TT-V-51 grade B).
73. Rust-preventive coating for control cables (U. S. Army Specification No. 2-82). Dip in rust preventive at 71°C (160°F) and drain.
78. Lacquer—Dull black—two coats (Duco No. 258-2801, or equivalent).
81. Lacquer—Dark green—one coat (Duco No. 258-2801, or equivalent).
82. Aluminum tanks (except water tanks).  
Flush inside with Calol flushing oil, or equivalent.
83. Primer—One coat.  
Lacquer—Dull black—one coat (Duco No. 258-2801, or equivalent).
87. Olive drab camouflage enamel—One coat, (U. S. Army Specification No. 14109).
88. Neutral gray camouflage enamel—One coat (U. S. Army Specification No. 14109).
92. Nitrate dope—Semi-pigmented—three coats—brushed.  
Nitrate dope—Aluminum pigmented—three coats—sprayed.
93. Nitrate dope—Yellow semi-pigmented—three brush coats, Specification No. AN-TT-D-556.  
Nitrate camouflage dope—Fully pigmented—at least two spray coats as required, U. S. Army Specification No. 14106.
98. White surfacer—One coat (Fuller's Synalac industrial lacquer No. 7799, or equivalent).  
Dark green lacquer—Two coats (Duco No. 258-38154, or equivalent).
99. Clear lacquer—Two coats (Fuller's Synalac clear finish No. 7700, or equivalent).
100. Magnesium and magnesium base alloys.  
Chromate treatment—in accordance with Specification AN-M-12.
101. Aluminum alloy bolt and rivet spacers shall not be anodized or painted.
122. Anodize.  
Primer—One coat.  
Carbon black tinted primer—One coat.
130. Cadmium plate.  
Primer—One coat.  
Carbon black tinted primer—One coat.
184. Zinc chromate primer—One coat.  
Carbon black tinted primer—One coat after assembly.
186. Carbon black tinted primer—One coat.





## SECTION VIII

### TUBING CHART



#### 1. GENERAL.

The various operating systems of the airplane employ numerous types and sizes of rigid and flexible tubing, as indicated on the applicable system diagrams.

#### 2. TUBING IDENTIFICATION.

The tubing of each system is identified by color bands at the end of each tube. Place identification tape on tube in conspicuous place. Place tape as follows:

- a. Be sure surfaces are clean and dry.
- b. Moisten tape with water and band the tube. Tape should overlap one-quarter turn.
- c. After applying, allow sufficient time for adhesive to dry.
- d. Brush a coat of clear lacquer, Specification AN-TT-L-51, on the tape. Make sure the edges of the tape are covered. Proper application of lacquer will prevent deterioration of identification tape.
- e. Store tape in a cool, dry place—away from dampness and heat.
- f. If identification tape is not available, paint suitable colored stripes on the tube to designate system. Protect when dry with a coat of shellac. If paint is not available, identify the tube in the best way possible, perhaps by glueing a piece of white paper, on which the name of the line is printed clearly, around the tube. Protect the paper with a coat of shellac.

#### 3. TUBE SIZES AND LENGTHS.

In replacing a damaged tube, select a tube of the same material and size of the damaged tube. Cut the piece of tubing approximately 10 percent longer than the length of the tube to be replaced. After required bends have been made, the new tube will be 1/2 to two inches longer than the old tube. Allowances should be made

for the flaring operation to follow. The amount of tubing in excess of these required dimensions should be cut off.

#### 4. TUBE TEMPLATE.

a. If the old tube is intact and the bends have not been changed, use it as a template or pattern from which to bend a new tube.

b. If a new model or template must be made, select a soft iron wire or a 1/8-inch tube; either of these may be easily bent by hand.

(1) Place the material selected for use as a template into one of the fittings where the tube is to be connected. Form the necessary bends in order to place the opposite end of the template into the other connection. When the template is satisfactorily formed to span the area between the two fittings, remove and use the pattern to bend a new tube.

(2) Select a path with the least total degrees of bend as this reduces the flow loss and simplifies bending.

(3) Use the path requiring the simplest bends.

(4) Use a path, if possible, with all bends in the same plane.

(5) Never select a path that requires no bends. A tube cannot be cut or flared accurately enough so that it can be installed without bends and still avoid initial mechanical strain on the tube. Bends are also necessary for expansion and contraction resulting from changes in temperature.

(6) Lay out a path providing for supports.

#### Note

The inside bend radius of all tubing (other than structural and conduit tubing) should be

System	Tubing Materials	Reference Figures
Fuel	52 SO, Copper	Fuel System Diagram, figure 199
Hydraulics	52 SO, Copper	Hydraulic System Diagram, figure 280
	Corr. Res. Steel	
	52 SO, Copper	Oil System Diagram, figure 189
	Optional { Everdur bronze	
	{ Duronze V Mixture 609	
	{ Silicon	
Pitot	52 SO	Flight Instruments Diagram, figure 227
Static	52 SO, 25 1/2H	Flight Instruments Diagram, figure 227
Fire Extinguisher	52 SO	Fire Extinguisher Diagram, figure 336
Vacuum	25-1/2H	Vacuum Deicer System Diagram, figure 355
Deicer	25-1/2H, 3 SO	Vacuum Deicer System Diagram, figure 355
Anti-Icing	52 SO, Copper	Propeller Anti-Icer System, figure 359
Oxygen	52 SO	Oxygen System Diagram, figure 361
Glycol	52 SO, Corr. Res. Steel	Heating & Ventilating System Diagram, figure 347
Manifold Pressure	Copper	Instrument Tubing Diagram, figure 229
Turbosupercharger Lubrication	52 SO	Turbosupercharger Lubrication System Diagram, figure 149
Electrical Conduit	25-1/2H	

Tube Dia.	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1.00	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{3}{4}$	2.00
*Recommended	1.60	1.60	1.70	1.95	2.00	2.10	2.25	2.50	2.70	2.70	2.70	2.80	3.40	3.60
*Minimum	1.40	1.40	1.50	1.75	1.75	1.85	2.00	2.25	2.40	2.40	2.40	2.50	3.10	3.30
Tube Dia.	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1.00	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{3}{4}$	2.00
*Length	2.25	2.25	2.25	2.35	2.65	2.75	3.00	3.40	3.75	3.90	3.90	4.10	4.75	5.00

\*Minimum length of straight tube flared on both ends.  
\*Distance from flared end of tube to start of bend.

at least 2-1/2 times the outside diameter of the tube. Bends in flared tubes shall not be closer to the flared end than the minimum distances specified above.

The length of any straight tube flared on both ends shall not be less than the length specified above.

#### Note

Place supports as close to bends as possible to minimize the amount of overhang of the tube.

### 5. TUBE CUTTING.

a. Use a standard cutting tool and cut the tube at right angles to the surface. Be careful to avoid forcing tube out of round. A hack saw may be used if a standard cutting tool is not available.

b. After the tube has been cut off, file the end square using a fine-toothed flat file. The tube may be held in a tube vise or flaring block while filing. If a hack saw was used for cutting, the tube ends must be filed until all saw marks are removed.

c. After filing, remove all burrs from the inside and outside of the tubes. A burnishing spoon is suitable for this purpose.

### 6. TUBE BENDING.

a. Tube bending may be accomplished with any one of a variety of hand-bending tools or power production bending tools. Care must be taken to avoid bending in

smaller radius than the limits of the tube will allow, also to avoid flattening, kinked, or wrinkled bends.

b. Bending tube without the aid of tools can be accomplished by carefully forming desired radius by hand. This method is crude but can be employed in emergency. It is suggested that tubing 1/2-inch O.D. or larger be packed with very fine dry sand, unless "Cerro-bend" or equivalent is available, and both ends of the tube be plugged before attempting to create bend. This will aid in preventing cracked or wrinkled bends and form a more acceptable radius. Bending should follow by forming a large radius in the tube and gradually working it down to the radius desired. When this operation is accomplished, the sand and plugs are removed and the pipe must be thoroughly cleansed of all foreign matter before installation.

### 7. FLARING TUBE END.

a. Select the proper flaring tool and vise for the tube to be worked. With a hammer-type tool, tap the pin lightly first, then use more force. Exercise care to avoid cracking tube ends and over flaring. In the event a flaring pin and block are not available, a ball peen hammer can be substituted for the flaring operation. Secure the tube and form the flange with the round end of the hammer by tapping the opposite end lightly with another hammer. This method is not recommended for shop practice.



b. Check the flare by placing a "T" sleeve over the tube; the outside diameter of the flare should extend beyond the toe of the sleeve but not beyond the outside diameter of the sleeve. Tubes that are flared too long will stick and jam on the threads when assembling and are likely to seat on the bottom of the coupling rather than on the tapered seat. Flares that are too short may be squeezed thin on installation to prevent full utilization of the clamping area.

#### 8. INSTALLING A TUBE.

a. Take a piece of clean cloth as large as can be pulled through the tube; attach a wire to the cloth six inches longer than the tube. Thread the wire through the tube and pull the cloth through as many times as is necessary to free the inside of oil, grease, or any other foreign matter.

b. A check should be made of flares to determine if the inside is clean.

c. Lubricate the exposed external tube machining threads with a thin film of lubricant on the first two threads, (selected from the following thread compound chart).

Straight thread installations using gaskets AN901, AN902, or 32F5712 shall be made with white lead compound AN-C-53 applied for faying surfaces of gasket only.

Petrolatum Specification AN-VV-P-236, or lead soap base grease, U. S. Army Specification 2-118 may be used on most straight thread aluminum alloy fittings.

Pipe thread joints should be sealed with compound, Specification AN-C-53.

Where operating temperatures exceed 82.2°C (180°F) use anti-seize compound AN-VV-C-566.

Grease, Specification AN-G-14 should be used on fittings in the oil and fuel systems.

Anti-seize and sealing compound, AN-C-84 *only* must be used on all oxygen pipe threads. Proper tinning of brass pipe threads is also acceptable for sealing purposes in the oxygen system.

d. Place the tube in position and take up the nut finger tight.

e. With an end or crescent wrench, hold the fitting in position while the nut is taken up to the proper torque with a torque wrench. (See table for maximum torque.) All tubing nuts must be tightened to not less than minimum torque as given in the torque load table below. In no case shall a tubing nut be tightened in excess of the maximum torque specified in torque load table below.

#### TORQUE LOADS IN POUND-INCHES

<i>Tubing Dia.</i> <i>Inches</i>	<i>Minimum</i> <i>Torque</i> <i>Lbs.-In.</i>	<i>Recommended</i> <i>Torque</i> <i>Lbs.-In.</i>	<i>Maximum</i> <i>Torque</i> <i>Lbs.-In.</i>
1/8	13	15	18
1/4	40	50	60
5/16	45	55	65
3/8	60	75	100
7/16	75	100	150
1/2	150	175	200
9/16	160	185	220
5/8	170	200	240
3/4	315	360	450
7/8	370	450	550
1	450	550	650
1-1/8	525	675	825
1-1/4	600	800	1000
1-1/2	675	900	1125
1-3/4	800	1050	1325
2	900	1200	1500

These torque loads are for tightening AC811 Parker tube fittings on 52 SO lines using aluminum alloy BT nuts and standard AC811 or modified sleeves. This table should be used merely as a reference point in judging the approximate torque loads required for any particular combination of fitting and material. Torque loads for these same fittings used with steel tubing will run 10 to 50 percent higher.

f. Use of a torque wrench is strongly recommended to avoid over-tightening and consequent system failure.

g. Test the installation for tightness by applying the pressure to the system.

#### 9. TUBE LEAKS AND FAILURES; CAUSES, REMEDIES, AND PREVENTION.

a. GENERAL.—Trouble in a tubing system may be broadly classified into two groups; namely, leaks and failures.

b. LOCATING LEAKS.—Liquid leaks are sometimes hard to locate. Wipe the system clean and trace the flow of liquid to the source of leak. Leaks generally occur at joints, around shafts or seals, and infrequently at pin hold leaks in unit bodies.

##### c. LEAKS AT FLARE JOINTS RESULT FROM:

- (1) Poor flare, rough surface, cracks, and splits.
- (2) Insufficient wrench torque.
- (3) Too much wrench torque.
- (4) Damage to flares.
- (5) Foreign material under flares.
- (6) Bad fitting or mismatching parts.
- (7) Careless assembly, such as cross threading.
- (8) Thread seized or galled.

**d. LEAKS AT PIPE THREAD JOINTS RESULT FROM:**

- (1) Sealing compound washed out or not properly used.
- (2) Insufficient wrench torque.
- (3) Poor threads, either badly machined or damaged.
- (4) Galling or seizing of threads.
- (5) Careless assembly, such as cross threading.

**e. LEAKS AT STRAIGHT THREAD JOINTS USING FLAT METAL GASKETS WITH SERRATIONS MAY RESULT FROM:**

- (1) Seizing or galling of threads.
- (2) Too much or too little wrench torque.
- (3) Mismatched parts; damaged or improper serrations.
- (4) Wrong size gaskets, wrong type gaskets, or no gasket.
- (5) Re-use of gasket or careless assembly.

**f. LEAKS AT STRAIGHT THREADED JOINTS USING SYNTHETIC RUBBER TYPE GASKET MAY RESULT FROM:**

- (1) Improper positioning of gasket on the fitting.

- (2) Fitting on boss not properly positioned.

- (3) Not enough wrench torque to squeeze the gasket and make the seal.

- (4) Wrong size or defective gasket.

- (5) Seizing or galling threads; mismatched parts.

- (6) Careless assembly.

**g. FAILURES.**—If a tube bursts, it is generally because of faulty material since the tubing is designed to withstand several times the operating pressure to which it is subjected. Vibration resulting from chattering or because of insufficient support is also a common cause of failure.

**10. TUBING MATERIALS.**

<i>System</i>	<i>Material</i>
Fuel	52 SO, 24ST, Chrom-Moly-Steel
Hydraulics	52 SO, Chrom-Moly-Steel
Oil	52 SO, Chrom-Moly-Steel
Pitot, Static	52 SO, 24ST
Fire Extinguishing	52 SO
Vacuum	52 SO, 24ST
Air Pressure	52 SO
Heating Exhaust	52 SO, Stainless Steel
Anti-Icing	52 SO
Oxygen	52 SO





## SECTION II

### CHARTS AND TABLES



#### 1. MANUFACTURER'S FLEXIBLE CABLE CHART.

(Refer to figures 425 to 440.)

#### 2. WRENCH TORQUE VALUES FOR BOLTS AND NUTS.

For tightening elastic self locking and castellated nuts or bolts to the proper torque values, the following procedure is recommended.

1. Install the bolt or nut fairly tight to cut or free the threads.

2. Back it off.

3. Note the torque required to turn the nut or bolt before it is seated.

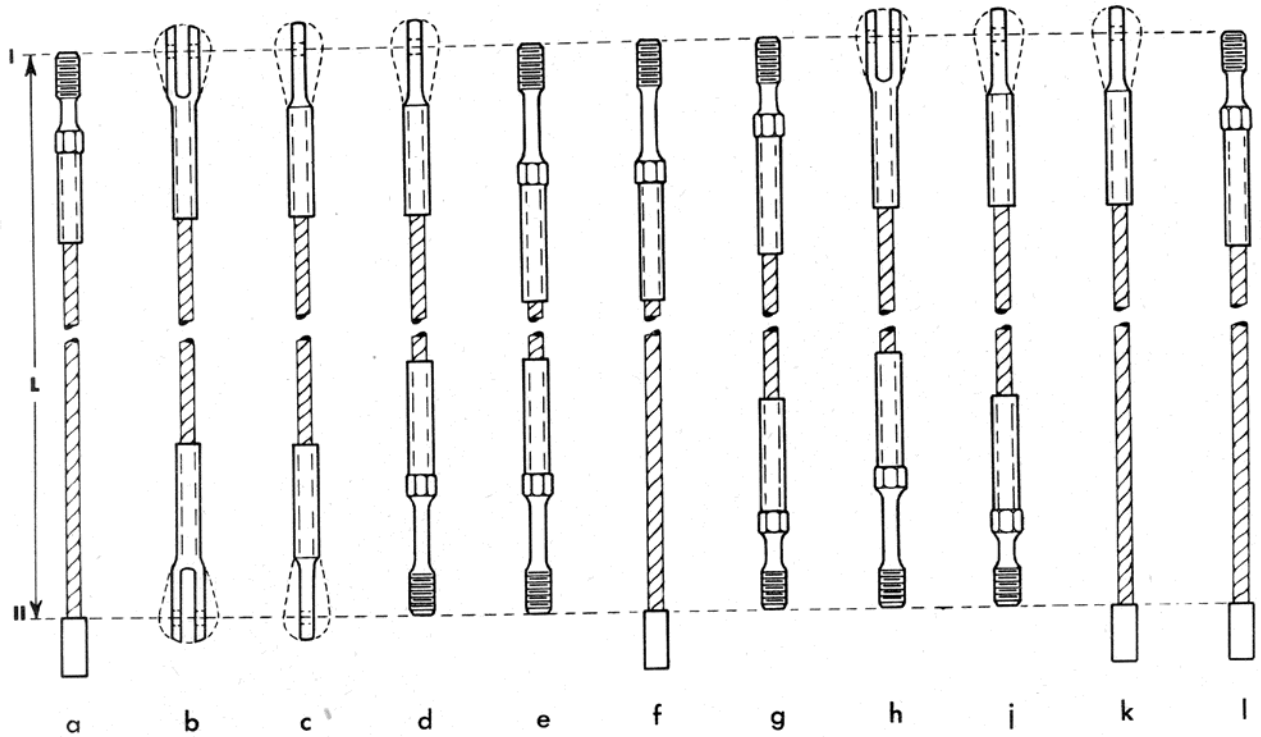
4. Tighten to the torque value shown on the chart, *plus* the torque value noted in step 3.

#### CAUTION

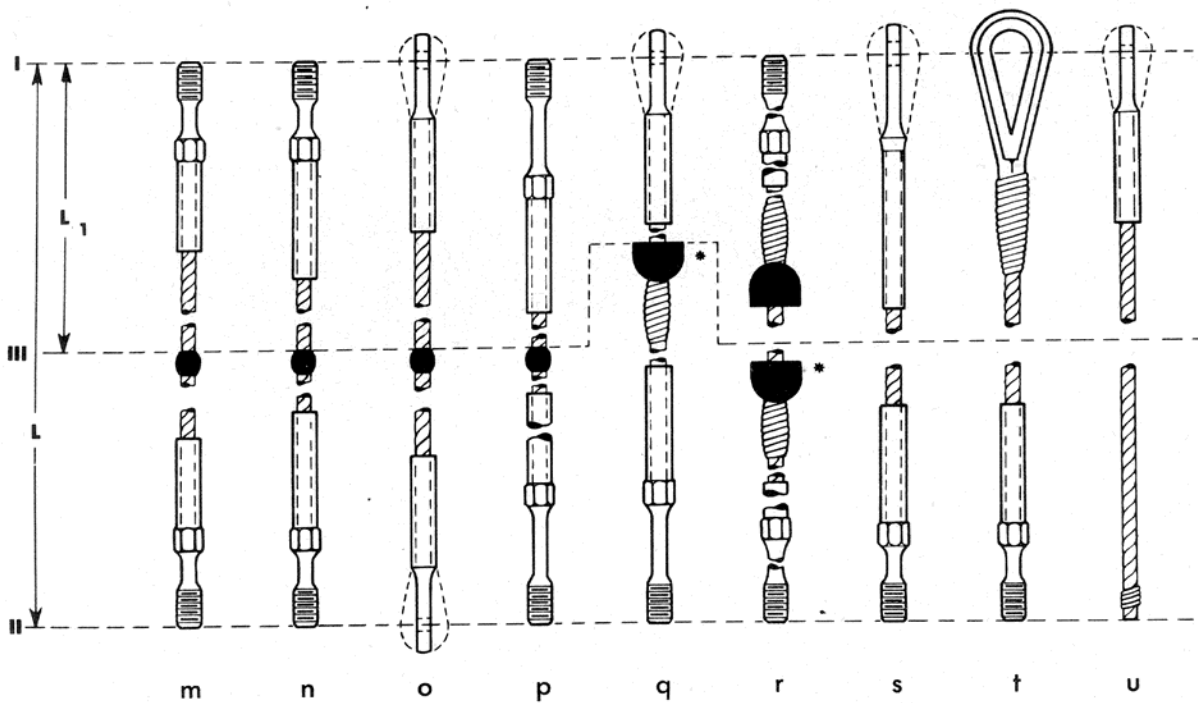
CLEAN BOTH NUTS AND BOLTS BEFORE USING. DIRT IN THE THREADS WILL SPOIL THE SETTING.

Bolt Size	STEEL		Internal Wrenching Nuts	ALUMINUM
	Self Locking & Castellated Nuts			Self Locking & Castellated Nuts
	Standard Type	Shear Type		Standard Type
	AC 365	AC 364		AC 365 D
	AN 310	AN 320		AN 310 D
TORQUE—POUND INCHES				
5/16	20-25	12-15		10-12
1/4 -28	50-70	30-40	65-90	25-35
5/16-24	100-140	60-85	130-180	50-70
3/8 -24	170-280	100-170	220-360	85-140
7/16-20	290-480	175-290	370-610	145-240
1/2 -20	490-740	300-450	630-950	250-370
9/16-18	800-1000	480-600	1000-1300	
5/8 -18	1100-1300	600-780	1400-1700	
3/4 -16	1900-2400	1100-1500	2400-3100	
7/8 -14	2900-3800	1700-2300	3700-4900	
1 -14	4000-6200	2400-3700	5100-7900	
1-1/8 -12	5400-7400	3200-4400	6900-9500	
1-1/4 -12	9000-11000	5400-6600	11500-14000	

Figure 424—Wrench Torque Table



ALL FITTINGS ARE SWAGED EXCEPT AS NOTED



ALL FITTINGS ARE SWAGED EXCEPT AS NOTED  
\*ADJUST AND SOLDER AFTER INSTALLATION

7-621

Figure 425—Cable Assembly Chart



(See Code Letters on Propeller Pitch Control System Diagram for Cable Location)

CODE SEE FIG. 168	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 168	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 168	TERMINAL II
				TOTAL "L"	TO STOP "L"				
				SEE FIG. 425	SEE FIG. 425				
A	BAC 1824-319-1208	f	AN 669-L3LH	120.8	.....	3/32	7 x 7	.....	BAC 1828-34
B	BAC 1824-319-1100	f	AN 669-L3LH	110.0	.....	3/32	7 x 7	.....	BAC 1828-34
C	BAC 1824-319-1321	f	AN 669-L3LH	132.1	.....	3/32	7 x 7	.....	BAC 1828-34
D	BAC 1824-319-1196	f	AN 669-L3LH	119.6	.....	3/32	7 x 7	.....	BAC 1828-34
E	BAC 1824-311-442	d	AN 668-3	44.2	.....	3/32	7 x 7	.....	AN 669-L3RH
F	BAC 1824-311-446	d	AN 668-3	44.6	.....	3/32	7 x 7	.....	AN 669-L3RH
G	BAC 1824-311-265	d	AN 668-3	26.5	.....	3/32	7 x 7	.....	AN 669-L3RH
H	BAC 1824-311-558	d	AN 668-3	55.8	.....	3/32	7 x 7	.....	AN 669-L3RH
J	BAC 1824-307-2012	c	AN 668-3	201.2	.....	3/32	7 x 7	.....	AN 668-3
K	BAC 1824-307-1992	c	AN 668-3	199.2	.....	3/32	7 x 7	.....	AN 668-3
L	BAC 1824-307-2570	c	AN 668-3	257.0	.....	3/32	7 x 7	.....	AN 668-3
M	BAC 1824-307-2530	c	AN 668-3	253.0	.....	3/32	7 x 7	.....	AN 668-3
N	BAC 1824-301-730	b	AN 667-3	73.0	.....	3/32	7 x 7	.....	AN 667-3
O	BAC 1824-301-730	b	AN 667-3	73.0	.....	3/32	7 x 7	.....	AN 667-3
P	BAC 1824-319-1186	f	AN 669-L3LH	118.6	.....	3/32	7 x 7	.....	BAC 1828-34
Q	BAC 1824-319-1315	f	AN 669-L3LH	131.5	.....	3/32	7 x 7	.....	BAC 1828-34
R	BAC 1824-319-1090	f	AN 669-L3LH	109.0	.....	3/32	7 x 7	.....	BAC 1828-34
S	BAC 1824-319-1202	f	AN 669-L3LH	120.2	.....	3/32	7 x 7	.....	BAC 1828-34
T	BAC 1824-311-437	d	AN 668-3	43.7	.....	3/32	7 x 7	.....	AN 669-L3RH
U	BAC 1824-311-452	d	AN 668-3	45.2	.....	3/32	7 x 7	.....	AN 669-L3RH
V	BAC 1824-311-558	d	AN 668-3	55.8	.....	3/32	7 x 7	.....	AN 669-L3RH
W	BAC 1824-311-265	d	AN 668-3	26.5	.....	3/32	7 x 7	.....	AN 669-L3RH
X	BAC 1824-307-1675	c	AN 668-3	167.5	.....	3/32	7 x 7	.....	AN 668-3
Y	BAC 1824-307-1675	c	AN 668-3	167.5	.....	3/32	7 x 7	.....	AN 668-3
Z	BAC 1824-307-1675	c	AN 668-3	294.8	.....	3/32	7 x 7	.....	AN 668-3
AA	BAC 1824-307-2852	c	AN 668-3	285.2	.....	3/32	7 x 7	.....	AN 668-3
BB	BAC 1824-301-740	b	AN 667-3	74.0	.....	3/32	7 x 7	.....	AN 667-3
CC	BAC 1824-301-740	b	AN 667-3	74.0	.....	3/32	7 x 7	.....	AN 667-3

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 426—Cable Chart—Propeller Pitch Control System

(See Code Letters on Intercooler Control System Diagram for Cable Location)

CODE SEE FIG. 167	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 167	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 167	TERMINAL II
				TOTAL "L"	TO STOP "L"				
				SEE FIG. 425	SEE FIG. 425				
A	BAC 1824-310-940	d	AN 668-3	94.0	.....	3/32	7 x 7	.....	AN 669-L3LH
B	BAC 1824-310-533	d	AN 668-3	53.3	.....	3/32	7 x 7	.....	AN 669-L3LH
C	BAC 1824-310-719	d	AN 668-3	71.9	.....	3/32	7 x 7	.....	AN 669-L3LH
D	BAC 1824-310-821	d	AN 668-3	82.1	.....	3/32	7 x 7	.....	AN 669-L3LH
E	BAC 1824-311-403	d	AN 668-3	40.3	.....	3/32	7 x 7	.....	AN 669-L3RH
F	BAC 1824-311-746	d	AN 668-3	74.6	.....	3/32	7 x 7	.....	AN 669-L3RH
G	BAC 1824-311-399	d	AN 668-3	39.9	.....	3/32	7 x 7	.....	AN 669-L3RH
H	BAC 1824-311-686	d	AN 668-3	68.6	.....	3/32	7 x 7	.....	AN 669-L3RH
J	BAC 1824-307-608	c	AN 668-3	60.8	.....	3/32	7 x 7	.....	AN 668-3
K	BAC 1824-307-1249	c	AN 668-3	124.9	.....	3/32	7 x 7	.....	AN 668-3
L	BAC 1824-307-2610	c	AN 668-3	261.0	.....	3/32	7 x 7	.....	AN 668-3
M	BAC 1824-307-1950	c	AN 668-3	195.0	.....	3/32	7 x 7	.....	AN 668-3
N	BAC 1824-310-1339	d	AN 668-3	133.9	.....	3/32	7 x 7	.....	AN 669-L3LH
O	BAC 1824-310-1299	d	AN 668-3	129.9	.....	3/32	7 x 7	.....	AN 669-L3LH
P	BAC 1824-310-1389	d	AN 668-3	138.9	.....	3/32	7 x 7	.....	AN 669-L3LH
Q	BAC 1824-310-1350	d	AN 668-3	135.0	.....	3/32	7 x 7	.....	AN 669-L3LH
R	BAC 1824-311-346	d	AN 668-3	34.6	.....	3/32	7 x 7	.....	AN 669-L3RH
S	BAC 1824-311-400	d	AN 668-3	40.0	.....	3/32	7 x 7	.....	AN 669-L3RH
T	BAC 1824-311-746	d	AN 668-3	74.6	.....	3/32	7 x 7	.....	AN 669-L3RH
U	BAC 1824-311-686	d	AN 668-3	68.6	.....	3/32	7 x 7	.....	AN 669-L3RH
V	BAC 1824-307-599	c	AN 668-3	59.9	.....	3/32	7 x 7	.....	AN 668-3
W	BAC 1824-307-1258	c	AN 668-3	125.8	.....	3/32	7 x 7	.....	AN 668-3
X	BAC 1824-307-1946	c	AN 668-3	194.6	.....	3/32	7 x 7	.....	AN 668-3
Y	BAC 1824-307-2610	c	AN 668-3	261.0	.....	3/32	7 x 7	.....	AN 668-3

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 427—Cable Chart—Intercooler Control System

(See Code Letters on Throttle Control System Diagram for Cable Location)

CODE SEE FIG. 165	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 165	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 165	TERMINAL II
				TOTAL "L"	TO STOP "L"				
A	BAC 1824-319-960	f	AN 669-L3LH	96.0	.....	3/32	7 x 7	.....	BAC 1828-34
B	BAC 1824-319-1178	f	AN 669-L3LH	117.8	.....	3/32	7 x 7	.....	BAC 1828-34
C	BAC 1824-319-1061	f	AN 669-L3LH	106.1	.....	3/32	7 x 7	.....	BAC 1828-34
D	BAC 1824-319-1274	f	AN 669-L3LH	127.4	.....	3/32	7 x 7	.....	BAC 1828-34
E	BAC 1824-311-322	d	AN 668-3	32.2	.....	3/32	7 x 7	.....	AN 669-L3RH
F	BAC 1824-311-449	d	AN 668-3	44.9	.....	3/32	7 x 7	.....	AN 669-L3RH
G	BAC 1824-311-480	d	AN 668-3	48.0	.....	3/32	7 x 7	.....	AN 669-L3RH
H	BAC 1824-311-624	d	AN 668-3	62.4	.....	3/32	7 x 7	.....	AN 669-L3RH
J	BAC 1824-307-1334	c	AN 668-3	133.4	.....	3/32	7 x 7	.....	AN 668-3
K	BAC 1824-307-1362	c	AN 668-3	136.2	.....	3/32	7 x 7	.....	AN 668-3
L	BAC 1824-307-2304	c	AN 668-3	230.4	.....	3/32	7 x 7	.....	AN 668-3
M	BAC 1824-307-2285	c	AN 668-3	228.5	.....	3/32	7 x 7	.....	AN 668-3
N	BAC 1824-319-1284	f	AN 669-L3LH	128.4	.....	3/32	7 x 7	.....	BAC 1828-34
O	BAC 1824-319-1063	f	AN 669-L3LH	106.3	.....	3/32	7 x 7	.....	BAC 1828-34
P	BAC 1824-319-971	f	AN 669-L3LH	97.1	.....	3/32	7 x 7	.....	BAC 1828-34
Q	BAC 1824-319-1174	f	AN 669-L3LH	117.4	.....	3/32	7 x 7	.....	BAC 1828-34
R	BAC 1824-311-624	d	AN 668-3	62.4	.....	3/32	7 x 7	.....	AN 669-L3RH
S	BAC 1824-311-322	d	AN 668-3	32.2	.....	3/32	7 x 7	.....	AN 669-L3RH
T	BAC 1824-311-480	d	AN 668-3	48.0	.....	3/32	7 x 7	.....	AN 669-L3RH
U	BAC 1824-311-449	d	AN 668-3	44.9	.....	3/32	7 x 7	.....	AN 669-L3RH
V	BAC 1824-307-1362	c	AN 668-3	136.2	.....	3/32	7 x 7	.....	AN 668-3
W	BAC 1824-307-2304	c	AN 668-3	230.4	.....	3/32	7 x 7	.....	AN 668-3
X	BAC 1824-307-1326	c	AN 668-3	132.6	.....	3/32	7 x 7	.....	AN 668-3
Y	BAC 1824-307-2285	c	AN 668-3	228.5	.....	3/32	7 x 7	.....	AN 668-3

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 428—Cable Chart—Throttle Control System

(See Code Letters on Mixture Control System Diagram for Cable Location)

CODE SEE FIG. 166	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 166	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 166	TERMINAL II
				TOTAL "L"	TO STOP "L"				
A	BAC 1824-319-1177	f	AN 669-L3LH	117.7	.....	3/32	7 x 7	.....	BAC 1828-34
B	BAC 1824-319-1123	f	AN 669-L3LH	112.3	.....	3/32	7 x 7	.....	BAC 1828-34
C	BAC 1824-319-989	f	AN 669-L3LH	98.9	.....	3/32	7 x 7	.....	BAC 1828-34
D	BAC 1824-319-911	f	AN 669-L3LH	91.1	.....	3/32	7 x 7	.....	BAC 1828-34
E	BAC 1824-311-295	d	AN 668-3	29.5	.....	3/32	7 x 7	.....	AN 669-L3RH
F	BAC 1824-311-444	d	AN 668-3	44.4	.....	3/32	7 x 7	.....	AN 669-L3RH
G	BAC 1824-311-601	d	AN 668-3	60.1	.....	3/32	7 x 7	.....	AN 669-L3RH
H	BAC 1824-311-434	d	AN 668-3	43.4	.....	3/32	7 x 7	.....	AN 669-L3RH
J	BAC 1824-307-1395	c	AN 668-3	139.5	.....	3/32	7 x 7	.....	AN 668-3
K	BAC 1824-307-1342	c	AN 668-3	134.2	.....	3/32	7 x 7	.....	AN 668-3
L	BAC 1824-307-2314	c	AN 668-3	234.0	.....	3/32	7 x 7	.....	AN 668-3
M	BAC 1824-307-2314	c	AN 668-3	231.4	.....	3/32	7 x 7	.....	AN 668-3
N	BAC 1824-319-1145	f	AN 669-L3LH	114.5	.....	3/32	7 x 7	.....	BAC 1828-34
O	BAC 1824-319-990	f	AN 669-L3LH	99.0	.....	3/32	7 x 7	.....	BAC 1828-34
P	BAC 1824-319-1076	f	AN 669-L3LH	122.8	.....	3/32	7 x 7	.....	BAC 1828-34
Q	BAC 1824-319-1076	f	AN 669-L3LH	107.6	.....	3/32	7 x 7	.....	BAC 1828-34
R	BAC 1824-311-444	d	AN 668-3	44.4	.....	3/32	7 x 7	.....	AN 669-L3RH
S	BAC 1824-311-434	d	AN 668-3	43.4	.....	3/32	7 x 7	.....	AN 668-L3RH
T	BAC 1824-311-295	d	AN 668-3	39.5	.....	3/32	7 x 7	.....	AN 668-L3RH
U	BAC 1824-311-601	d	AN 668-3	60.1	.....	3/32	7 x 7	.....	AN 668-L3RH
V	BAC 1824-307-1395	c	AN 668-3	139.5	.....	3/32	7 x 7	.....	AN 668-3
W	BAC 1824-307-1342	c	AN 668-3	134.2	.....	3/32	7 x 7	.....	AN 668-3
X	BAC 1824-307-2378	c	AN 668-3	237.8	.....	3/32	7 x 7	.....	AN 668-3
Y	BAC 1824-307-2256	c	AN 668-3	225.6	.....	3/32	7 x 7	.....	AN 668-3

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 429—Cable Chart—Mixture Control System



(See Code Letters on Aileron Control System Diagram for Cable Location)

CODE SEE FIG. 239	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 239	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 239	TERMINAL II
				TOTAL "L"	TO STOP "L"				
				SEE FIG. 425	SEE FIG. 425				
A	BAC 1824-610-837	d	AN 668-6	83.7	.....	3/16	7 x 19	.....	AN 669-L6LH
B	BAC 1824-610-1039	d	AN 668-6	103.9	.....	3/16	7 x 19	.....	AN 669-L6LH
C	BAC 1824-611-1125	d	AN 668-6	112.5	.....	3/16	7 x 19	.....	AN 669-L6RH
D	BAC 1824-611-1125	d	AN 668-6	112.5	.....	3/16	7 x 19	.....	AN 669-L6RH
E	BAC 1824-608-719	j	AN 668-6	71.9	.....	3/16	7 x 19	.....	AN 669-S6LH
F	BAC 1824-608-735	j	AN 668-6	73.5	.....	3/16	7 x 19	.....	AN 669-S6LH
G	BAC 1824-610-2534	d	AN 668-6	253.4	.....	3/16	7 x 19	.....	AN 669-L6LH
H	BAC 1824-610-2651	d	AN 668-6	265.1	.....	3/16	7 x 19	.....	AN 669-L6LH
J	BAC 1824-605-893	h	AN 667-6	89.3	.....	3/16	7 x 19	.....	AN 669-L6LH
K	BAC 1824-610-955	d	AN 668-6	95.5	.....	3/16	7 x 19	.....	AN 669-L6LH
L	BAC 1824-413-812	g	AN 669-S4LH	81.2	.....	1/8	7 x 19	.....	AN 669-S4LH
M	1-18205-90-7R	s	1-20527	90.9	.....	1/8	7 x 19	.....	AN 669-S4RH
N	1-18205-73-5L	s	1-20527	73.6	.....	1/8	7 x 19	.....	AN 669-S4RH
O	BAC 1824-610-1040	d	AN 668-6	104.0	.....	3/16	7 x 19	.....	AN 669-L6LH
P	BAC 1824-610-1040	d	AN 668-6	104.0	.....	3/16	7 x 19	.....	AN 669-L6LH
Q	BAC 1824-607-901	c	AN 668-6	90.1	.....	3/16	7 x 19	.....	AN 668-6
R	BAC 1824-607-1081	c	AN 668-6	108.1	.....	3/16	7 x 19	.....	AN 668-6
S	BAC 1824-608-713	j	AN 668-6	71.3	.....	3/16	7 x 19	.....	AN 669-S6LH
T	BAC 1824-608-733	j	AN 668-6	73.3	.....	3/16	7 x 19	.....	AN 669-S6LH
U	BAC 1824-610-2731	d	AN 668-6	273.1	.....	3/16	7 x 19	.....	AN 669-L6LH
V	BAC 1824-610-2463	d	AN 668-6	246.3	.....	3/16	7 x 19	.....	AN 669-L6LH
W	BAC 1824-610-955	d	AN 668-6	95.5	.....	3/16	7 x 19	.....	AN 669-L6LH
X	BAC 1824-605-893	h	AN 667-6	89.3	.....	3/16	7 x 19	.....	AN 669-L6LH
Y	BAC 1824-610-1596	d	AN 668-6	159.6	.....	3/16	7 x 19	.....	AN 669-L6LH
Z	BAC 1824-610-1596	d	AN 668-6	159.6	.....	3/16	7 x 19	.....	AN 669-L6LH
AA	BAC 1824-610-1596	d	AN 668-6	159.6	.....	3/16	7 x 19	.....	AN 669-L6LH
BB	BAC 1824-610-1596	d	AN 668-6	159.6	.....	3/16	7 x 19	.....	AN 669-L6LH

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 430—Cable Chart—Aileron Control System

(See Code Letters on Elevator Control System Diagram for Cable Location)

CODE SEE FIG. 250	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 250	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 250	TERMINAL II
				TOTAL "L"	TO STOP "L"				
				SEE FIG. 425	SEE FIG. 425				
A	BAC 1824-607-905	c	AN 668-6	90.5	.....	3/16	7 x 19	.....	AN 668-6
B	BAC 1824-605-2812	h	AN 667-6	281.2	.....	3/16	7 x 19	.....	AN 669-L6LH
C	BAC 1824-618-3094	e	AN 669-L6RH	309.4	.....	3/16	7 x 19	.....	AN 669-L6LH
D	BAC 1824-605-3505	h	AN 667-6	350.5	.....	3/16	7 x 19	.....	AN 669-L6LH
E	BAC 1824-611-2556	d	AN 668-6	255.6	.....	3/16	7 x 19	.....	AN 669-L6RH
F	BAC 1824-412-811	g	AN 669-S4LH	81.1	.....	1/8	7 x 19	.....	AN 669-S4LH
G	BAC 1824-605-361	h	AN 667-6	36.1	.....	3/16	7 x 19	.....	AN 669-L6LH
H	BAC 1824-607-905	c	AN 668-6	90.5	.....	3/16	7 x 19	.....	AN 668-6
J	BAC 1824-610-3505	d	AN 668-6	350.5	.....	3/16	7 x 19	.....	AN 669-L6LH
K	BAC 1824-605-2812	h	AN 667-6	281.2	.....	3/16	7 x 19	.....	AN 669-L6LH
L	BAC 1824-611-2798	d	AN 668-6	279.8	.....	3/16	7 x 19	.....	AN 669-L6RH
M	BAC 1824-618-2912	e	AN 669-L6RH	291.2	.....	3/16	7 x 19	.....	AN 669-L6LH
N	BAC 1824-605-294	h	AN 667-6	29.4	.....	3/16	7 x 19	.....	AN 669-L6LH
O	BAC 1824-606-432	h	AN 667-6	43.2	.....	3/16	7 x 19	.....	AN 669-L6RH
P	BAC 1824-606-459	h	AN 667-6	45.9	.....	3/16	7 x 19	.....	AN 669-L6RH
Q	BAC 1824-606-459	h	AN 667-6	45.9	.....	3/16	7 x 19	.....	AN 669-L6RH
R	BAC 1824-606-432	h	AN 667-6	43.2	.....	3/16	7 x 19	.....	AN 669-L6RH

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 431—Cable Chart—Elevator Control System

(See Code Letters on Rudder Control System Diagram for Cable Location)

CODE SEE FIG. 246	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 246	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 246	TERMINAL II
				TOTAL "L"	TO STOP "L"				
A	BAC 1824-607-279	c	AN 668-6	27.9	.....	3/16	7 x 19	.....	AN 668-6
B	BAC 1824-608-980	j	AN 668-6	98.0	.....	3/16	7 x 19	.....	AN 669-S6LH
C	BAC 1824-610-1340	d	AN 668-6	134.0	.....	3/16	7 x 19	.....	AN 669-L6LH
D	BAC 1824-610-2685	d	AN 668-6	268.5	.....	3/16	7 x 19	.....	AN 669-L6LH
E	BAC 1824-618-3081	e	AN 669-L6RH	308.1	.....	3/16	7 x 19	.....	AN 669-L6LH
F	BAC 1824-462-994	g	AN 669-S4LH	99.4	.....	1/8	7 x 19	.....	AN 669-S4LH
G	BAC 1824-601-820	b	AN 667-6	82.0	.....	3/16	7 x 19	.....	AN 667-6
H	BAC 1824-607-279	c	AN 668-6	27.9	.....	3/16	7 x 19	.....	AN 668-6
J	BAC 1824-608-980	j	AN 668-6	98.0	.....	3/16	7 x 19	.....	AN 669-S6LH
K	BAC 1824-610-1340	d	AN 668-6	134.0	.....	3/16	7 x 19	.....	AN 669-L6LH
L	BAC 1824-610-2685	d	AN 668-6	268.5	.....	3/16	7 x 19	.....	AN 669-L6LH
M	BAC 1824-618-3081	e	AN 669-L6RH	308.1	.....	3/16	7 x 19	.....	AN 669-L6LH
N	BAC 1824-601-820	b	AN 667-6	82.0	.....	3/16	7 x 19	.....	AN 667-6
O	1-18205-9	s	1-20527	9.0	.....	1/8	7 x 19	.....	AN 669-S4RH

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 432—Cable Chart—Rudder Control System

(See Code Letters on Aileron, Rudder and Elevator Trim Tab Control System Diagram for Cable Location)

CODE SEE FIG. 249	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 249	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 249	TERMINAL II
				TOTAL "L"	TO STOP "L"				
A	BAC 1807-512-0L	f	AN 669-L3LH	512.0	.....	3/32	7 x 7	.....	BAC 1828-34
B	BAC 1824-319-4385	f	AN 669-L3LH	438.5	.....	3/32	7 x 7	.....	BAC 1828-34
C	BAC 1807-505-4L	f	AN 669-L3LH	505.5	.....	3/32	7 x 7	.....	BAC 1828-34
D	BAC 1824-316-2285	e	AN 669-L3RH	228.5	.....	3/32	7 x 7	.....	AN 669-L3LH
E	55-7034-404	r	AN 669-L3RH	82.0	*	3/32	7 x 7	21-7379 (2)	AN 669-L3LH
F	55-7034-405	r	AN 669-L3RH	74.5	*	3/32	7 x 7	21-7379 (2)	AN 669-L3LH
G	BAC 1824-320-2751	f	AN 669-L3RH	275.1	.....	3/32	7 x 7	.....	BAC 1828-34
H	BAC 1807-267-3R	f	AN 669-L3RH	267.4	.....	3/32	7 x 7	.....	BAC 1828-34
J	BAC 1807-131-1R	f	AN 669-L3RH	131.1	.....	3/32	7 x 7	.....	BAC 1828-34
K	BAC 1807-589-5L	f	AN 669-L3LH	589.6	.....	3/32	7 x 7	.....	BAC 1828-34
L	BAC 1824-320-2751	f	AN 669-L3RH	275.1	.....	3/32	7 x 7	.....	BAC 1828-34
M	BAC 1807-197-6R	f	AN 669-L3RH	197.8	.....	3/32	7 x 7	.....	BAC 1828-34
N	BAC 1807-68-0L	f	AN 669-L3LH	68.0	.....	3/32	7 x 7	.....	BAC 1828-34
O	BAC 1807-291-7R	f	AN 669-L3RH	291.9	.....	3/32	7 x 7	.....	BAC 1828-34
P	BAC 1807-261-7R	f	AN 669-L3RH	261.9	.....	3/32	7 x 7	.....	BAC 1828-34
Q	55-7034-400	q	AN 668-3	270.3	32.12	3/32	7 x 7	21-7379	AN 669-L3LH
R	55-7034-401	q	AN 668-3	237.5	2.12	3/32	7 x 7	21-7379	AN 669-L3LH
S	BAC 1805-61-7	k	AN 668-3	61.9	.....	3/32	7 x 7	.....	BAC 1828-34
T	BAC 1805-61-7	k	AN 668-3	61.9	.....	3/32	7 x 7	.....	BAC 1828-34

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

\*STOPS ADJUSTED ON INSTALLATION.

Figure 433—Cable Chart—Aileron, Rudder and Elevator Trim Tab Control System



(See Code Letters on Tail Wheel and Surface Lock Control System Diagram for Cable Location)

CODE SEE FIG. 248	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 248	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 248	TERMINAL II
				TOTAL "L"	TO STOP "L <sub>1</sub> "				
A	BAC 1824-310-3624	d	AN 668-3	362.4	.....	3/32	7 x 7	.....	AN 669-L3LH
B	BAC 1824-311-2605	d	AN 668-3	260.5	.....	3/32	7 x 7	.....	AN 669-L3RH
C	BAC 1824-308-440	j	AN 668-3	44.0	.....	3/32	7 x 7	.....	AN 669-S3LH
D	BAC 1824-310-4040	d	AN 668-3	404.0	.....	3/32	7 x 7	.....	AN 669-L3LH
E	BAC 1824-316-2791	e	AN 669-L3RH	279.1	.....	3/32	7 x 7	.....	AN 669-L3LH
F	BAC 1824-310-3625	d	AN 668-3	362.5	.....	3/32	7 x 7	.....	AN 669-L3LH
G	BAC 1824-316-3003	e	AN 669-L3RH	300.3	.....	3/32	7 x 7	.....	AN 669-L3LH

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 434—Cable Chart—Tail Wheel and Surface Lock Control System

(See Code Letter on Bomb and Bomb Door Control System Diagram for Cable Location)

CODE SEE FIG. 85	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 85	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 85	TERMINAL II
				TOTAL "L"	TO STOP "L <sub>1</sub> "				
A	BAC 1824-319-1178	f	AN 669-L3LH	117.8	.....	3/32	7 x 7	.....	BAC 1828-34
B	BAC 1824-317-1173	l	AN 669-S3LH	117.3	.....	3/32	7 x 7	.....	BAC 1828-34
C	BAC 1824-308-1260	j	AN 668-3	126.0	.....	3/32	7 x 7	.....	AN 669-S3LH
D	BAC 1824-312-574	k	AN 668-3	57.4	.....	3/32	7 x 7	.....	BAC 1828-34
E	BAC 1824-318-578	l	AN 669-S3RH	57.8	.....	3/32	7 x 7	.....	BAC 1828-34
F	BAC 1833-J536-1035	n	AN 669-S3RH	103.5	56.3	3/32	7 x 7	BAC 1831-13	AN 669-S3RH
G	BAC 1833-G150-265	n	AN 669-S3LH	26.5	15.0	3/32	7 x 7	BAC 1831-13	AN 669-S3LH
H	BAC 1833-J606-1150	n	AN 669-S3RH	115.0	60.6	3/32	7 x 7	BAC 1831-13	AN 669-S3RH
J	BAC 1834-853-1703	o	AN 668-3	170.3	85.3	3/32	7 x 7	BAC 1831-13	AN 668-3
K	1-16650-43-0	t	AN 100-4	43.0	.....	3/32	7 x 7	.....	AN 669-S3RH
L	15-11194-14	c	AN 668-3	87.5	.....	3/32	7 x 7	.....	AN 668-3
M	1-16650-98-1	t	AN 100-4	98.2	.....	3/32	7 x 7	.....	AN 669-S3RH
N	BAC 1824-308-1323	j	AN 668-3	132.3	.....	3/32	7 x 7	.....	AN 669-S3LH
O	BAC 1824-320-1310	l	AN 669-S3LH	120.8	.....	3/32	7 x 7	.....	BAC 1828-34
P	BAC 1824-320-1348	f	AN 669-L3LH	124.1	.....	3/32	7 x 7	.....	BAC 1828-34
Q	15-11194-20	l	AN 669-S3LH	95.8	.....	3/32	7 x 7	.....	BAC 1828-34
R	15-11194-2	l	AN 669-S3LH	129.8	.....	3/32	7 x 7	.....	BAC 1828-34
S	BAC 1833-K540-981	p	AN 669-L3RH	98.1	54.0	3/32	7 x 7	BAC 1831-13	AN 669-L3RH
T	BAC 1833-G1169-2332	n	AN 669-S3LH	233.2	116.9	3/32	7 x 7	BAC 1831-13	AN 669-S3LH
U	BAC 1833-G147-261	n	AN 669-S3LH	26.1	14.7	3/32	7 x 7	BAC 1831-13	AN 669-S3LH
V	15-11194-10	c	AN 668-3	117.0	.....	3/32	7 x 7	.....	AN 668-3
W	1-16650-43-0	t	AN 100-4	43.0	.....	3/32	7 x 7	.....	AN 669-S3RH
X	1-16650-98-1	t	AN 100-4	98.2	.....	3/32	7 x 7	.....	AN 669-S3RH

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 435—Cable Chart—Bomb and Bomb Door Control System

(See Code Letters on Instrument Vacuum Control System Diagram for Cable Location)

CODE SEE FIG. 230	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 230	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 230	TERMINAL II
				TOTAL "L"	TO STOP "L <sub>1</sub> "				
A	BAC 1824-310-555x	d	AN 668-3	55.5	.....	3/32	7 x 7	.....	AN 669-L3LH
B	BAC 1824-310-506x	d	AN 668-3	50.6	.....	3/32	7 x 7	.....	AN 669-L3LH
C	BAC 1824-311-240x	d	AN 668-3	24.0	.....	3/32	7 x 7	.....	AN 669-L3RH
D	BAC 1824-311-240x	d	AN 668-3	24.0	.....	3/32	7 x 7	.....	AN 669-L3RH

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

Figure 436—Cable Chart—Instrument Vacuum Control System

(See Code Numbers on Engine Fire Extinguisher Control System Diagram for Cable Location)

CODE SEE FIG. 337	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 337	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 337	TERMINAL II
				TOTAL "L"	TO STOP "L <sub>1</sub> "				
I	65-5715-501	k	AN 668-3	121.0	.....	3/32	7 x 7	.....	BAC 1828-34
II	65-5715-507	u	AN 668-3	114.0	.....	3/32	7 x 7	.....	*
III	65-5715-502	k	AN 668-3	115.6	.....	3/32	7 x 7	.....	BAC 1828-34
IV	65-5715-508	u	AN 668-3	112.0	.....	3/32	7 x 7	.....	*

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

\*WRAP END WITH 5 TURNS OF .047 WIRE. FRAY CABLE AND SOLDER.

Figure 437—Cable Chart—Engine Fire Extinguisher Control System

(See Code Number on Cabin Heating Control System Diagram for Cable Location)

CODE SEE FIG. 348	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 348	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 348	TERMINAL II
				TOTAL "L"	TO STOP "L <sub>1</sub> "				
I	BAC 1807-108-0L	f	AN 669-L3LH	108.0	.....	3/32	7 x 7	.....	BAC 1828-34
II	BAC 1807-120-0L	f	AN 669-L3LH	120.0	.....	3/32	7 x 7	.....	BAC 1828-34
III	BAC 1807-49-3R	f	AN 669-L3LH	49.4	.....	3/32	7 x 7	.....	BAC 1828-34
IV	BAC 1807-58-0R	f	AN 669-L3LH	58.0	.....	3/32	7 x 7	.....	BAC 1828-34

NOTE: THIS CHART WAS MADE FROM THE CURRENTLY INACTIVE B.A.C. STANDARDS AND ALSO APPEARS IN THIS FORM ON THE DIAGRAM. BAC 1807 HAS BEEN REPLACED BY BAC 1824. THE LENGTH APPEARING IN THE BAC CABLE ASSY. NO. IS GIVEN IN INCHES AND 1/8 INCREMENTS, WHILE THE FIGURE GIVEN IN THE LENGTH COLUMN APPEARS IN INCHES AND TENTHS. FOR EXAMPLE—BAC 1807-49-3R = 49-3/8" OR 49.4, 4 BEING AS CLOSE TO 3/8 AS PRACTICABLE. THE CODE IS ALSO GIVEN IN NUMERALS INSTEAD OF LETTERS.

Figure 438—Cable Chart—Cabin Heating Control System



(See Code Numbers on Tail Gun Sight Control System Diagram for Cable Location)

SEE FIG. 406 CODE	CABLE ASSY. NUMBER	TYPE SEE FIG. 425	TERMINAL I SEE FIG. 406	CABLE LENGTHS IN INCHES		DIAM. OF CABLE	STRANDS	INTERMEDIATE FITTINGS-STOPS III SEE FIG. 406	TERMINAL II
				TOTAL "L"	TO STOP "L <sub>1</sub> "				
				SEE FIG. 406	SEE FIG. 425				
1	BAC 1790-12-5L	m	AN 669-2LH	21.83	13.08	1/16	7 x 7	BAC 1831-12	AN 669-2LH
2	BAC 1824-206-203	a	AN 669-2RH	20.30	.....	1/16	7 x 7	.....	BAC 1828-23
3	BAC 1824-206-248	a	AN 669-2RH	24.80	.....	1/16	7 x 7	.....	BAC 1828-23
4	BAC 1805-5-3L	a	AN 669-2LH	5.40	.....	1/16	7 x 7	.....	BAC 1828-23
5	BAC 1824-206-168	a	AN 669-2RH	16.80	.....	1/16	7 x 7	.....	BAC 1828-23
6	BAC 1824-206-168	a	AN 669-2RH	16.80	.....	1/16	7 x 7	.....	BAC 1828-23
7	BAC 1805-5-3L	a	AN 669-2LH	5.40	.....	1/16	7 x 7	.....	BAC 1828-23

NOTE: FOR CABLE ASSEMBLY USE CHART SHOWN ABOVE—FOR CABLE INSTALLATION USE CONTROL SYSTEM DIAGRAM.

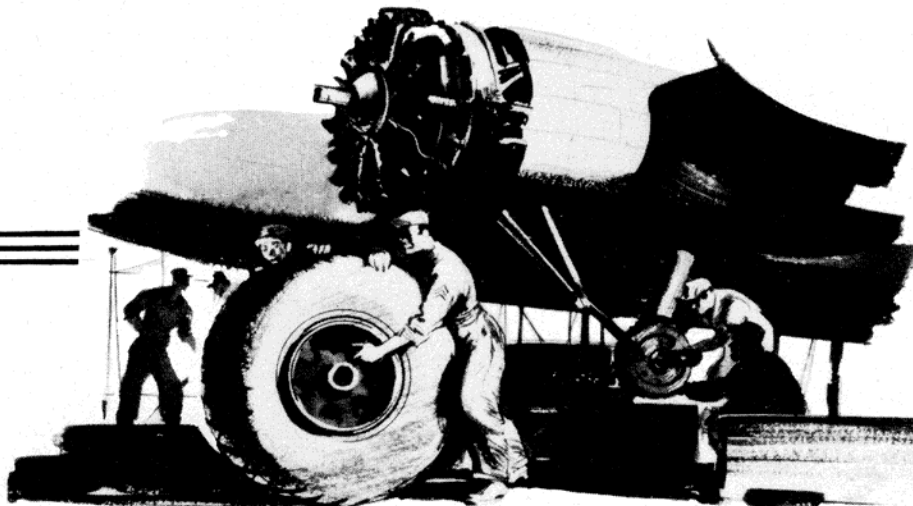
Figure 439—Cable Chart—Tail Gun Sight Control System

MULTIPLY	BY	TO OBTAIN	MULTIPLY	BY	TO OBTAIN
Atmospheres .....	76.0 .....	cms. of mercury	Miles, nautical .....	1.85325 .....	kilometers
Atmospheres .....	29.92 .....	inches of mercury	Miles, nautical .....	1.1516 .....	miles, statute
Atmospheres .....	14.70 .....	lbs./sq. inch	Miles/hr. ....	88 .....	feet/min.
Barrels—oil .....	31.50 .....	gallons—oil	Miles/hr. ....	1.467 .....	feet/sec.
Fathoms .....	6 .....	feet	Miles/hr. ....	1.609 .....	kilometers/hr.
Feet .....	1.64468 x 10 <sup>-4</sup> ..	miles—nautical	Miles/hr. ....	0.8684 .....	knots
Feet .....	5280 .....	miles—statute	Miles/hr. ....	26.82 .....	meters/min.
Gal., British Imperial .....	1.20091 .....	U. S. Gallons	Millibars .....	0.02955 .....	inches of mercury
Gal., British Imperial .....	0.160538 .....	Cubic Feet	Pounds, avoirdupois .....	453592 .....	kilograms
Gal., British Imperial .....	4.54596 .....	liters	Pounds, avoirdupois .....	4.464x10 <sup>-4</sup> .....	tons, long
Gallons, U.S. ....	0.832702 .....	Imperial Gallons	Pounds, avoirdupois .....	4.53592x10 <sup>-4</sup> .....	tons, metric
Gallons/min. ....	0.06308 .....	liters/sec.	Revolutions .....	360 .....	degrees
Gallons/min. ....	8.0208 .....	cu. ft./hour	Revolutions .....	6.283 .....	radians
Horsepower (U.S.) .....	42.44 .....	B.T.U./min.	Revolutions/min (RPM) ...	6 .....	degrees/sec.
Horsepower (U.S.) .....	33,000 .....	foot lbs./min.	Revolutions/min (RPM) ...	0.1047 .....	radians/sec.
Horsepower (U.S.) .....	550 .....	foot lbs./sec.	Revolutions/min (RPM) ...	0.1667 .....	revs/sec.
Liters .....	0.26417 .....	gallons, U. S.	Temp. (°C) + 273.15° .....	1 .....	abs. temp. (°C)
Miles, statute .....	1609.35 .....	meters	Temp. (°C) 17.776° .....	1.8 .....	Temp. (°F)
Miles, statute .....	5280 .....	feet	Temp. (°F) + 459.6° .....	1 .....	abs. temp. (°F)
Miles, statute .....	1.60935 .....	kilometers	Temp. (°F) -32° .....	0.5555 (or 5/9) .....	Temp. (°C)
Miles, statute .....	1760 .....	yards	Tons (short) .....	2000 .....	pounds
Miles, statute .....	0.8684 .....	miles, nautical	Tons (short) .....	.892857 .....	tons (long)
Miles, nautical .....	6008.204 .....	feet	Tons (U.S. Shipping) .....	1.050 .....	tons, British Shipping

Figure 440—Table of Miscellaneous Conversion Factors

## **SECTION I**

### **SERVICE INSPECTION**



#### **INDEX TO COLUMN NUMBERS**

The inspections outlined in this section are arranged to correspond with the columns on Army Air Forces Form 41B, the corresponding column numbers being found to the left of the pertinent paragraphs.

##### *Column*

- 10—Preflight Inspection
- 11—Bombing
- 12—Gunnery
- 13—Tow Target
- 14—Chemical
- 15—Communications
- 16—Photographic
- 17—Navigation
- 18—Special Inspections
- 19—Daily Inspections (Power Plant)
- 20—Engine Controls
- 21—Engine Instruments
- 22—Ignition and Electrical
- 23—Fuel System
- 24—Oil System
- 25—Cooling System
- 26—Valves
- 27—Manifolds and Superchargers

##### *Column*

- 28—Propellers and Accessories
- 29—Power Plant—General
- 30—Daily Inspections (Airplane—General)
- 31—Cockpits and Cabins
- 32—Flight Control Mechanism
- 33—Movable Surfaces
- 34—Fixed Surfaces
- 35—Fuel Tanks
- 36—Tail Wheel Gear
- 37—Landing Gear
- 38—Wheels and Brakes
- 39—Hydraulic System
- 40—Fuselage
- 41—Oxygen Equipment
- 42—Night Flying Equipment
- 43—Airplane—General
- 44—Navigation Instruments
- 45—Remarks
- 46—Batteries

Results of these inspections will be recorded on Maintenance Inspection Record, Army Air Forces Form No. 41B, which is maintained for each airplane.



**PREFLIGHT INSPECTION***(To be performed prior to the first flight of the day)***BEFORE STARTING ENGINES***Col***General**

- 10 Examine the airplane flight report for completeness. If it is incomplete, make the necessary entries to complete it.

Note whether routine inspections are due. If they are due and cannot be made, see that the proper symbols are entered to indicate the omission of the inspection.

Check the contents of the aircraft data case for completeness. The data case for this airplane shall contain one copy of each of the following Technical Orders: 00-20A (Visual Inspection System for Airplanes) 01-20EG-1 (Pilot's Handbook of Flight Operating Instructions), 01-20EG-2 (Handbook of Erection and Maintenance Instructions), 01-1-40 (Weight and Balance Handbook), 02-1-38 (Use of Alternate Grade Fuel, Aircraft Engines), 02-35GC-2 (Service Instructions - R-1820-97, 08-15-1 (Radio Facilities Charts), 08-15-2 (Radio Data and Aids to Airways Flying), and 8-15-3 (Instrument Approach Procedures). These orders and the current supplements and amendments thereto will remain with the aircraft at all times and will be kept in the aircraft data case when not being used for reference purposes.

See that pilot's check list is accessible to the pilot.

Check flight engineer's report for gross weight and center of gravity location. The center of gravity should be between 19 percent and 32 percent of the mean aerodynamic chord.

**Fuel and Oil Tanks**

Inspect self-sealing fuel and oil tanks for evidence of deterioration. Inspect the structure surrounding the cells for any leakage of fuel between the cells and the surrounding structure which may be caused by improper attachment of fittings or partial failure of any tank outlet connection. Such failures will be immediately indicated by leakage of fluid to the outside of the airplane, except in the case of cells installed in a sealed structure. In a sealed structure, the first indication of this type of failure will be collapse of the cells. Inspect all fittings attached to the cells, which are visible through quick opening access doors, for leaks.

Check the quantities of fuel and oil in all tanks. Fill if necessary and enter the quantities on the airplane flight report, form No. 1A. (This check must be made on the day the airplane is to be flown, prior to the first flight of the day. Checks

*Col* made on a previous day cannot be considered part of the preflight inspection prescribed by these instructions.) Fill the engine oil tanks with lubricating oil, Specification AN-VV-O-446. Refer to Section III, paragraph 2. *b.*, for servicing instructions.

The filler necks for the oil tanks in No. 1 and No. 4 nacelles are reached through access doors on the outboard sides of the nacelles, and the filler necks for the oil tanks in No. 2 and No. 3 nacelles are reached through access doors on the inboard sides of the nacelles. A stick type gage, graduated to indicate proper oil level for 850 and 1700 U. S. (708 and 1416.1 Imperial) gallons of fuel, is carried on the inboard side of No. 3 nacelle, immediately aft of the oil tank.

See that oil tank caps are secured after filling tanks.

Fill the fuel tanks with 100 octane fuel. Specification AN-F-28. Refer to Section III, paragraph 2. *b.* for servicing instruction.

**CAUTION**

Make sure that the E-5 transfer valves are closed before refueling. This is to prevent overflow of the inner wing tanks if the outer wing tanks are filled first.

Generally the fuel supply hose will reach all three main tank fillers in one wing if it is brought up over the leading edge of the wing between nacelles. The wing area between spars may be walked on with reasonable caution, but the skin should be protected by quilts, canvas, or plywood panels in order to prevent scratching.

**WARNING**

Do not permit the filler hose to make contact with the inner liner of the self-sealing tanks. The nozzle may puncture the liner and allow fuel leakage into the sealant layer, rendering the tank useless in a short time.

**CAUTION**

Do not drag servicing over deicer shoe.

If bomb bay fuel tanks are installed, check for proper installation, security of mounting, and "OFF" position of bomb release control switch on the side in which the tank is installed. The filler necks are located on the upper inboard side of each tank, aft of the bomb racks, and access will be from below through the bomb bay doors.

**DANGER**

**Col** 10 The airplane must be thoroughly grounded before attempting the refueling operation. If fuel is supplied from an underground tank, an electrical ground must be made near the gasoline pit. If the airplane is refueled from a truck, both the airplane and the truck must be grounded. Failure to apply proper grounding will permit the accumulation of static electricity, with the consequent hazard of explosion or fire. Since the use of a covering ordinarily insulates a man from the structure and thus permits static charges to be built up in his body, it will be positively necessary in every case to drag a hand over the metal surface of the wing for a considerable distance before touching the airplane adjacent to an open filler neck.

Each time the fuel tanks are filled, drain all fuel strainers and fuel tank drains to remove any accumulation of foreign matter and water from the sumps. Make sure that all drain cocks are properly resafetied. See that wing tank scupper drains are clear.

**CAUTION**

Self-sealing fuel tank drains must be secured by a wrench applied to the shoulder of the drain while operating the drain cock to prevent torque from being transmitted to the fuel tank, which would cause the fitting to tear loose. Extreme care must be exercised by all personnel handling fuel tanks to prevent damage to the fittings.

See that all fuel tank caps are secured after filling the tanks.

**Turbosuperchargers**

**LUBRICATION.**—Check the supercharger lubricating oil supply, and fill if necessary with oil specification No. AN-VV-O-446, grade 1065. For cold weather operation, ground temperature below  $-9.4^{\circ}\text{C}$  ( $+15^{\circ}\text{F}$ ) fill supply tank with hydraulic fluid specification AN-VV-O-366A.

The outboard turbosupercharger lubricating oil tanks may be serviced through the access door in the upper surface of each outboard nacelle. Inboard tanks must be serviced through the access door on the lower surface of the wing immediately aft of the rear spar. Access to the inboard tanks is limited and necessitates use of a one-quart container. A funnel should be used in either case to prevent spillage.

**WARNING**

**Col** 10 Extreme care will be taken when servicing, to prevent foreign matter from entering the supercharger lubricating oil. The smallest particle of dirt or grit can cause supercharger bearing failure. A closed container must be used to protect the oil from sand or other foreign matter.

Using a flashlight, check as much of the turbosupercharger lubricating system as possible for leaks and for security of the mounting. If leaks are found in the lubrication system, repair or replace the affected parts.

**Note**

Oil seepage from the turbosupercharger oil seal into the bucket wheel and cooling cap is permissible when the turbosupercharger is idle.

**INDUCTION SYSTEM.**—Beam a flashlight into each air induction scoop to make certain that no foreign objects are present. Foreign materials in these intake scoops will cause serious damage to turbosupercharger or inter-cooler during operation and must be removed.

**TURBOSUPERCHARGERS.**—Spin the turbine bucket wheel by hand and see that the rotor rotates freely. If there is any internal rubbing or indication of bearing failure, replace the turbosupercharger.

Visually inspect the nozzle box and cooling cap for loose bolts. Replace any broken bolts or safety wires. If any of the bolts have stretched, replace them with new bolts, as tightening will lead to additional stretching and probable failure during operation.

Measure the maximum and minimum clearance between the turbine bucket wheel and nozzle box by inserting a shim gage radially into the clearance far enough so that the clearance of both the inner and outer ring of the nozzle diaphragm is measured. If the clearance at any point is greater than .160 inches or less than .070 inches, the turbosupercharger must be replaced.

Measure the maximum and minimum clearance between the cooling cap and the turbine bucket wheel. If the clearance is greater than .190 inches or less than .090 inches, rearrange the shims supporting the cooling cap until the clearance is within these limits around the entire circumference of the cooling cap rim.



**Col** Visually and manually inspect the turbosuper-  
10 charger wastegate to see that it operates freely. Inspect both the spindle and gate to see that they are not distorted or warped. If the wastegate or spindle is not serviceable, the wastepipe assembly must be repaired or replaced. If the spindle is bound with carbon, saturate the bearings with alcohol and work out the carbon by moving the spindle from side to side.

**WASTEGATES.**—Inspect the wastegate linkage.

Grasp wastegate lever by hand and shake it up and down. If there is any lost motion, locate the source of the lost motion and repair it.

**EXHAUST WASTEGATES.**—Inspect wastegates for evidence of warping or bending.

### CAUTION

Do not attempt to open or close the wastegate while the linkage is connected to the wastegate motor. Because of the brake in the motor, application of force will only place unnecessary strain on the linkage and the gear train in the motor.

With engines off, connect external power source. Turn inverter on and turn turboboost selector to "10." Then inspect all wastegates for uniformity of positions. If any gate is closed more than the other gates, it indicates that the calibrator setting on the engine has been changed to compensate for power plant defects. When this condition exists, carefully inspect the engine and engine accessories, performing the engine run-up test if necessary. Pay special attention to the possibility of induction system and exhaust stack leaks, as a very small leak would have great effect on turbo-supercharger operation at high altitudes.

After locating and correcting the defects in the engine or its accessories, recalibrate the turbo control for that engine, as outlined in the ground calibration procedure, Section IV, paragraph 6. b. (4).

**AMPLIFIERS.**—See that the amplifier cases in the turbo control system are not covered by parachutes, clothing, etc., preventing proper ventilation.

**TURBO BOOST SELECTOR.**—Turn dial clockwise to stop. When stop is reached, arrow should point to "8." Press dial-stop latch and turn dial to "10." The dial-stop latch should work freely. Turn dial counterlockwise to a point below "8," and check to see that dial stop re-engages. Return dial to "0" (turbos-off position) before starting the engine.

**Col**  
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### Propellers

Make sure ignition switches are "OFF" and then inspect propellers for bent or damaged blades. Inspect propeller blades for nicks, scratches, looseness, etc.

Check for oil leakage from the propeller hubs. Check constant speed propeller governors for external oil leaks around the governor base head.

### Batteries

Three 24-volt batteries are located in the nose section of the wing, two in the right wing and one in the left, adjacent to the fuselage. Access doors attached by Dzus fasteners are provided for servicing the batteries.

### WARNING

Personnel handling batteries should avoid inhaling battery fumes, as these fumes are extremely toxic. In case battery electrolyte is spilled on aluminum alloy parts of the airplane, wash off immediately with dilute sodium bicarbonate solution (one tablespoon to one pint of water). Flush thoroughly with water after fizzing stops. If sodium bicarbonate is not available use soap and water.

Take hydrometer readings on at least two cells of each battery.

Always return fluid to the cell from which it was withdrawn.

If any reading, corrected for temperature, is below 1.240 or above 1.310, turn battery in for recharge. Add distilled water as necessary; *never add electrolyte or acid.* In adding water to Presto-Lite batteries, bring the electrolyte up to the star level in the battery cover. In filling Exide batteries, do not exceed the level obtained by the use of a self-leveling syringe.

### Note

Electrolyte in batteries will freeze if exposed to low temperatures when partially or fully discharged, or if water is added and the battery is exposed before the water has been thoroughly mixed with electrolyte by charging. Do not add water when the temperature is below freezing, unless the airplane is to be operated within a few hours. Internal expansion caused by freezing will usually burst the case and destroy both plates and separators. A frozen battery may be saved, if the freezing has not progressed to the point that breakage occurs, by

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10

placing it in a room of normal temperature and allowing it to thaw slowly. Where low temperatures are to be encountered, batteries must be kept fully charged.

Inspect battery leads for corrosion, and check to see that vents are open. Inspect battery boxes for leakage and corrosion. If dirty or showing signs of corrosion, disconnect, scrape clean, reconnect. Then smear vaseline lightly over metal surfaces. Inspect felt pads in the battery vent sumps for proper condition. Keep the battery vent sumps (pint Mason jars) filled to the top of the vent felt pads with a solution of sodium bicarbonate.

### WARNING

Personnel handling batteries should avoid spilling battery electrolyte on the hands and body, as it may cause painful burns.

### Landing Gear

**GENERAL.**—Inspect the main landing gear and tail wheel gear for damage or obvious defects. Inspect wheels for distorted rim flanges or ribs and security or retaining nuts, bolts, and cotter pins.

**TIRES.**—Inspect tires for indication of tire slippage. If markings do not align, deflate tube and realign the tire to its original position on the wheel. Do not operate the airplane until this realignment is accomplished.

To obtain satisfactory operating characteristics, tire inflation pressures should vary with airplane

Col  
10 gross weight so as to maintain the prescribed rolling radius of the tires. It is recommended that preflight pressures be checked carefully, since the lighter landing weight, with depleted fuel and military load, has the effect of exaggerating any over-inflated condition.

Inflate main landing gear tires until the inflation marks are tangent to the ground line when the airplane is resting on a smooth level surface, and with the airplane loaded approximately as it will be flown. In the absence of these markers, inflate the main tires until the lowest point on the in-board side of the wheel rim is 8.50 inches above the ground. If the measurement is taken on the outboard side of the wheel, the rim will measure nine inches above the ground for the 56-inch tires due to the camber of the axle.

The inflation valve for the tail wheel tire is inside the cover plate on the tail wheel. Inflate the tail wheel tire until the inflation marks are tangent to the ground line when the airplane is resting on a smooth level surface. In the absence of these marks inflate until the lowest point of the wheel rim is 5.10 inches from the ground line.

### AIR-OIL SHOCK STRUTS.

#### DANGER

Inflammable gases—such as hydrogen, oxygen, and acetylene—must never be used for inflation or serious accidents may result.

Inflate the shock struts with compressed air only. The inflating device must be capable of developing pressure up to 800 pounds per square inch. A compressed air cylinder of approximately 2,000 pounds per square inch pressure is satisfactory, but must be handled carefully in order to avoid too rapid inflation. CO<sub>2</sub> may be substituted in emergencies, but its continued use is not recommended.

The main landing gear shock strut should be kept filled to the level of the filler opening. It is recommended that hydraulic fluid, Specification 3580, be used under all temperature conditions. To fill, remove the rubber grommet and loosen the air valve body sufficiently to release the air *slowly*. After the deflation, remove the valve body entirely, check the fluid level, and replenish if necessary. Replace the valve body and the rubber grommet.

Inflate the main landing gear strut until the centerline of the axle is extended 9.50 inches below the upper edge of the lower collar. The end of the strut cylinder butts against the axle knuckle and may be distinguished by the difference in finish between the two parts.

The instructions for replenishing the air and hydraulic fluid in the main landing gear shock strut also apply to the tail wheel gear shock strut. The

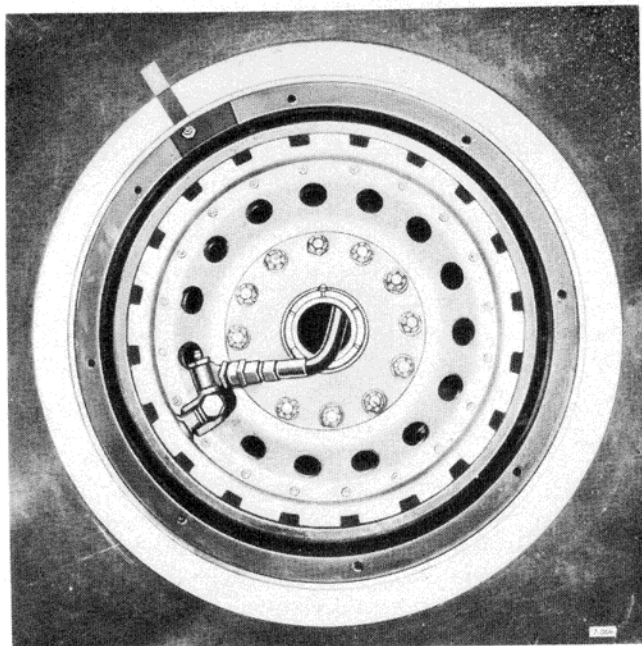


Figure 441—Slippage Marks—Main Landing Gear



Col air and hydraulic fluid filler valve is located on the upper left side of the cylinder assembly. The fluid should be level with the filler valve with the airplane in the taxiing position.

The air pressure required for the tail wheel gear shock strut inflation is from 400 to 500 pounds per square inch, depending upon the gross weight of the airplane. Inflate the strut until the oleo is extended 26.10 inches, the length being measured between the strut attaching pin centers. Maintain this dimension by inflation or deflation for the different conditions of airplane gross weight. After inflation, check the valve cores and bodies for leakage.

### CAUTION

Do not inflate the main landing gear shock strut beyond the  $9\frac{1}{2}$  inch dimension prescribed. The strut is designed to operate from that portion for all airplane loadings and should be inflated or deflated as required for each particular loading. Over-inflation will cause excessive stiffness, and the taxiing condition will be aggravated at landing because of the reduced weight of the airplane at the end of the flight.

**BRAKES.**—Check operation of the brake and parking brake controls. Each metering valve crosshead should travel  $15/16$  inch (minimum) downward before striking the metering valve casting. The parking brake when in the "OFF" position should not reduce this travel. The proper condition of the metering valves can be checked by depressing the brake pedals. In order to prevent inadvertent brake operation when using the rudder control, there should be approximately  $3/16$ -inch to  $1/4$ -inch travel of the crosshead before actual metering begins. The point at which meter-

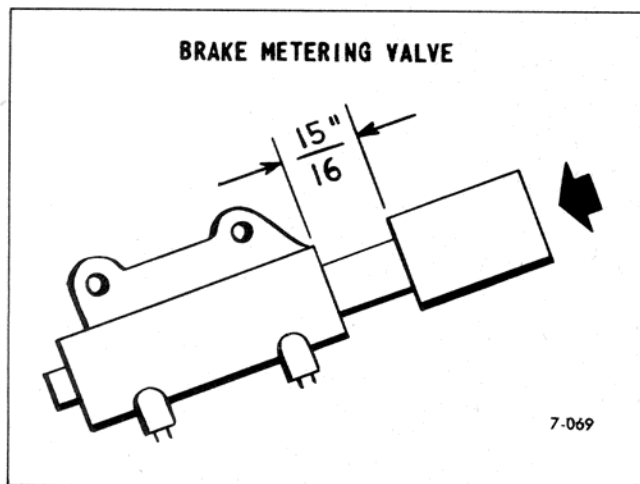


Figure 442—Crosshead Travel—Brake Metering Valve

Col ing begins can be determined by a sudden increase in the force required to depress the brakes.

### Air-Speed Tube

Remove the air-speed head protection covers and check the openings for freedom from obstructions. Test the heating units.

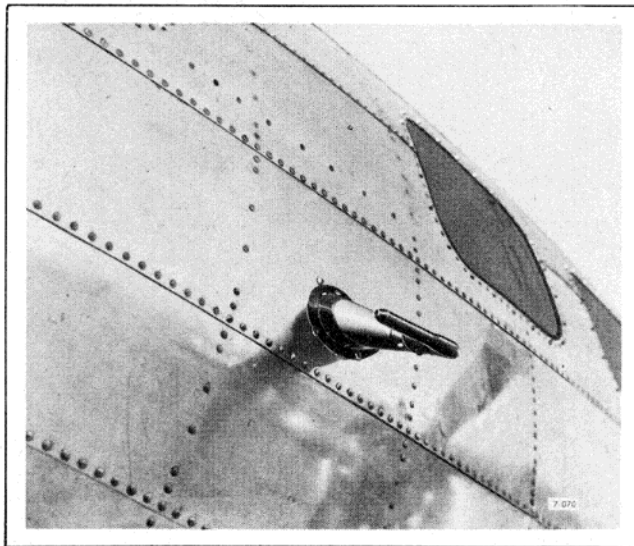


Figure 443—Pitot Mast Installation

### Engine Fire Extinguishers

(If Installed)

Check the red inspection discs of CO<sub>2</sub> engine fire extinguisher system for indication of rupture of the cylinder safety diaphragms. These discs are located on the lower surface of the right wing fairing, aft of the rear spar, and may be checked visually from the outside of the airplane. If discs indicate discharge, access for replacement of cylinders is through two removable panels in the web of the right side body compression strut.

The bottom gap cover may also be removed for access to the outboard side of the cylinders. Disconnect the control cables and the tubing and remove the straps for replacement of the cylinders. Install charged cylinders, replace straps, and re-safety.

### WARNING

If the release handle of the engine section fire extinguisher is tripped, complete emptying cannot be prevented. White discharge from CO<sub>2</sub> fire extinguishers is dry ice. Avoid frost bite. Do not permit extended contact with skin.

### Hand Fire Extinguishers

Check all extinguishers for security of mounting.

Col

### Deicer System

- 10 Inspect all deicer shoes for punctures, loose patches, and other obvious defects, and for freedom from oil.

If, when the airplane is moored in the open with a high wind blowing, the deicer shoes seem to ripple or undulate, inspect at once and replace if necessary, as a rippling or loose shoe may cause failure of the skin.

Engine oil will be removed from deicer shoes as soon as possible. Gasoline may be used to remove the oil, but it should be wiped dry at once with a clean dry rag and not allowed to evaporate. The deicer shoes may be washed with soap and water as part of the regular cleaning of the airplane. If rubber solvents are used for cleaning, the shoes should be wiped dry immediately. In no case will the black conductive surface on the deicer shoes be removed, except for the purpose of applying a patch.

Punctures may frequently occur in the shoes from static charges accumulating on the surface of the rubber. These accumulations discharge into the metallic surface on which the shoes are installed, puncturing both thicknesses of the rubber. In such cases, the punctures must be patched on both the front and back sides of the shoes. For patching instructions see Section IV, paragraph 7. g.

Check deicer lines in both wings and tail for security and general condition.

### CAUTION

Do not drag heavy gasoline hose over the deicer shoes, or lean ladders or maintenance platforms against them, unless the ladders or platforms are fitted with sponge rubber pads at the point of contact with the shoes. The deicer shoes are made of soft flexible rubber that is easily punctured.

### Anti-icer Equipment

Check the propeller anti-icer system for proper level of fluid in anti-icer tank. The supply tank has a capacity of 20 U. S. (16.7 Imperial) gallons and is located below the right side of the radio compartment floor. Replenishing is accomplished through the filler neck which extends above the floor. To avoid spilling, the use of a large funnel or a non-drip can is recommended. Fill with anti-icer fluid, Specification AN-F-13 isopropyl alcohol. A stick type gage is attached to the right side of bulkhead 5, directly forward of the tank.

Check the operation and condition of the windshield wiper blades, if installed.

### CAUTION

Do not operate wipers on dry wind-

Col  
10

shields as dirt and grit will damage wiper blades.

A tank of five U. S. gallons capacity, located in the pilot's cockpit enclosure between the top gun turret and the life raft compartments, supplies the windshield anti-icing system. The tank is filled through an access door on the top of the fuselage, aft of the top gun turret. Check for proper fluid level in the supply tank. Fill with anti-icer fluid, Specification AN-F-13. (Use only the Specified fluid.)

### Glycol Heating System

Check the proper level of fluid in the glycol supply tank which is located in the upper rear portion of the No. 2 nacelle. The filler well is accessible through a door in the nacelle skin on the upper surface just forward of the front spar. Fill the supply tank to the "FULL" on the stick gage. If the system is being replenished, run the engine until the glycol has filled the system, then add fluid to fill the tank to the "FULL" on the stick gage. The tank holds one U. S. (.80 Imperial) gallon and has expansion space of .30 U. S. gallon.

The approved fluid mixture for use in the glycol system has the composition shown below in percentage ratios by weight. Proportions must be held to close tolerances for satisfactory operation under extreme temperature conditions.

### Compositions:

55% Diethylene glycol.

45% Ethylene glycol.

Boiling Point: 204°C (400°F).

Freezing Point: -45°C (-50°F).

### WARNING

Any fluid other than that described above *must never be used*. It is particularly important that water or any anti-freeze solution *must never be added* to the glycol fluid, as this would destroy the usefulness of the approved mixture.

In the event that the indicated mixture is not available, no other fluid shall be used. To prevent damage to equipment caused by the system running dry, the glycol pump must be removed from the engine. Should this condition exist in excess of 25 hours of engine operation, the glycol heaters must be removed from the exhaust and replaced with steel plates to cover the holes.

### CAUTION

If the glycol tank is filled too full and boiling occurs, the vapor pressure may cause overflow and serious loss of the heating fluid.



Col

**Surfaces**

- 10 See that all trim tabs are in their proper positions. Check that the relative motion of the trim tabs, due to "play" in their control systems, does not exceed the maximum allowable values. (3/16 or .187 inches for the rudder and elevator tabs, and 5/32 or .156 inches for the aileron tab.)

Inspect wings, ailerons, elevators, rudder, and stabilizers for damage or obvious defects.

Check screws attaching wing tips to wing panels for tightness.

See that all cowling, inspection doors, and covers are properly fastened and secured.

**WARNING**

If frost is present on any of the airplane's flight surfaces, see that the frost is removed by brushing or flushing prior to take-off.

Unlock flight controls. Check visually and operate through the full range to insure proper movement.

Inspect the control column for positioning of elevators and ailerons in neutral position.

See that flight controls operate freely. Be sure that nothing in the compartments will interfere with control movement. If lost motion or binding is present, or if a full movement of the controls cannot be obtained, inspect the entire system to locate and correct the trouble.

Check tightness of the wing flap system by operating the flaps before starting the engines. If the flaps operate easily after the airplane has been idle 24 hours or more, the system is satisfactory.

**Oxygen Equipment****DANGER**

Due to the danger of combustion, extreme caution must be exercised when handling oxygen equipment. Keep the oxygen system clean and free of any oil or grease. Be sure hands and clothes are free from oil.

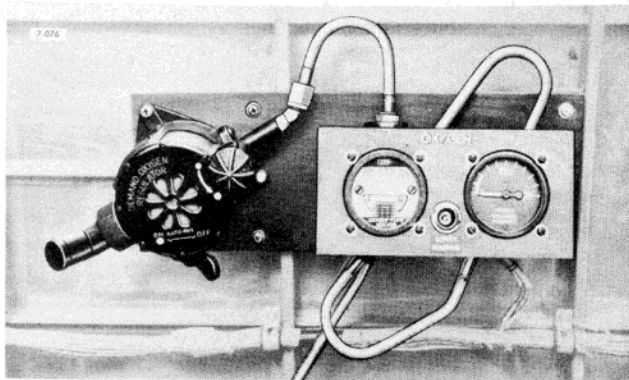


Figure 444—Typical Oxygen Panel Installation

- Col Make a visual inspection of all oxygen lines. Dam-  
10 aged lines will be replaced prior to flight.

Check oxygen pressure at each crew position to be sure that sufficient oxygen is available for the intended mission. If information relative to the mission is unavailable, the oxygen system will be filled to capacity.

**LOW PRESSURE OXYGEN CYLINDERS**

<i>State of Charge</i>	<i>Pounds Pressure</i>
Full .....	400
4/5 .....	330
3/5 .....	260
1/2 .....	225
2/5 .....	190
1/5 .....	120
Empty .....	50

Charge the oxygen system, following instructions in Section III, paragraph 2. *b*.

**Note**

The airplane oxygen cylinders will become quite warm while being charged. System pressure will drop 20 to 30 pounds per square inch when the cylinders cool to normal temperature.

After filling the airplane's oxygen system, be sure all filler valve plugs are installed.

**Hydraulic System**

Check the hydraulic fluid level in the supply tank. The hydraulic fluid supply tank has a capacity of 4.0 U. S. (3.3 Imperial) gallons and is located above the hydraulic panel on the rear bulkhead of the pilot's compartment. This tank must be kept filled to its proper level as indicated on the stick gage, with clean hydraulic oil, Specification AN-VV-O-366.

**Note**

The total fluid capacity of the hydraulic system is approximately 5.25 U. S. (4.37 Imperial) gallons for airplanes equipped with hydraulic gun chargers on the chin turret.

The accumulator air charge *must* be checked and brought within the limits of 325 to 375 pounds per square inch, and 800 pounds per square inch hydraulic pressure must be built up in the system before checking the fluid level.

Refer to Section III, paragraph 2. *b*. for instructions on servicing the hydraulic system.

**CAUTION**

Under no circumstances will any other fluid or oil be substituted for the specified hydraulic fluid.

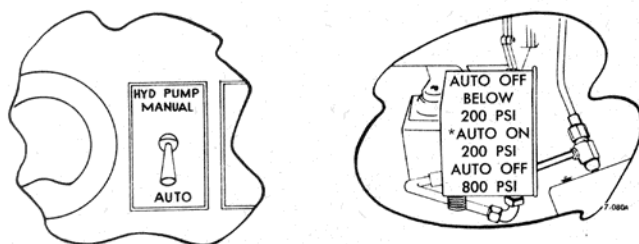


Figure 445—Operations Diagram—Hydraulic System

Col A consistent loss of fluid from day to day may indicate a leak in the system. The cause of such leakage should be determined immediately.

### CAUTION

To protect the batteries, the electric pump will be used only when the generators are charging or when an external source of power is available. In all other cases the hand pump must be employed as the source of pressure.

In extremely cold weather initial operation of the hydraulic system must be accomplished with extreme care. In case the parking brakes have been left on, they must be released and reapplied VERY SLOWLY to prevent cracking of the brake expander tubes. The hydraulic accumulator should be warmed to normal working temperature if facilities are available.

Cowl flap operating time should be from two to five seconds for each engine. A longer operating time indicates sediment in the speed control. Eliminate this condition by loosening the lock nut, rotating the speed control counterclockwise two turns, and operating all cowl flaps through two complete cycles. Readjust speed control to provide two to five seconds operation and tighten lock nut.

### Cockpit and Cabin

Check for presence of hand cranks and extensions on rear bulkhead of radio compartment.

Clean all compartments. All articles which could foul or jam controls will be properly attached, stowed, or removed.

### WARNING

Do not stow miscellaneous cargo in the airplane without the approval of the flight engineer. All loading *must* be in accordance with the center of gravity computing chart mounted on compartment door.

Check the condition and operation of the auxiliary generator unit, and for presence of electrical connecting cable.

Col See that windshield and windows are clean. Check 10 for cracked or broken glass. If found, replace.

### CAUTION

Use only soap and water, kerosene, or naphtha for cleaning transparent plastic panels. Never use benzene, acetone, or lacquer thinners, since they dissolve the plastic. Abrasive cleaners of any kind will scratch the panels and impair vision. Use a clean cloth.

Inspect windshield and sliding enclosures for condition of frame, security of attachment, and for condition and operation of mechanism on sliding parts.

Inspect the silica gel cartridges mounted on the window frames, and below the pilot's floor for the radio compass loop. If approximately half of the contents have turned light pink, replace with new silica gel crystals or re-activate as instructed in Section IV, paragraph 7. f. (1) (d).

Check all heating and ventilating outlets for condition and proper operation.

Check cabin door and emergency exits for condition and proper operation of releasing mechanism. Inspect fabric and leather parts of all safety belts for cuts or fraying. Inspect safety belt latching devices for condition and operation. Check fittings and attachment parts for condition and security of fastening. Belt catches should not be bent and should operate freely. Check for date of last weight test. All belts should be tested semi-annually, except type B-11, which is to be tested annually.

If necessary, replace with properly tested belts.

Check first-aid kits. If seal is broken check to determine items required for replacement. Required items will be obtained by requisition from the local Medical Department. First-aid kits are located in the navigator's compartment, on the back of the copilot's seat, on the rear bulkhead of the radio compartment, and on the bulkhead above the lower ball turret.

### Instruments

#### Note

In sub-zero weather, malfunctioning of all instruments, including autosyn indicators, may be avoided by preheating of the instrument panel. A standard type bathroom radiant heater, attached to an external source of power, can be used for this purpose.



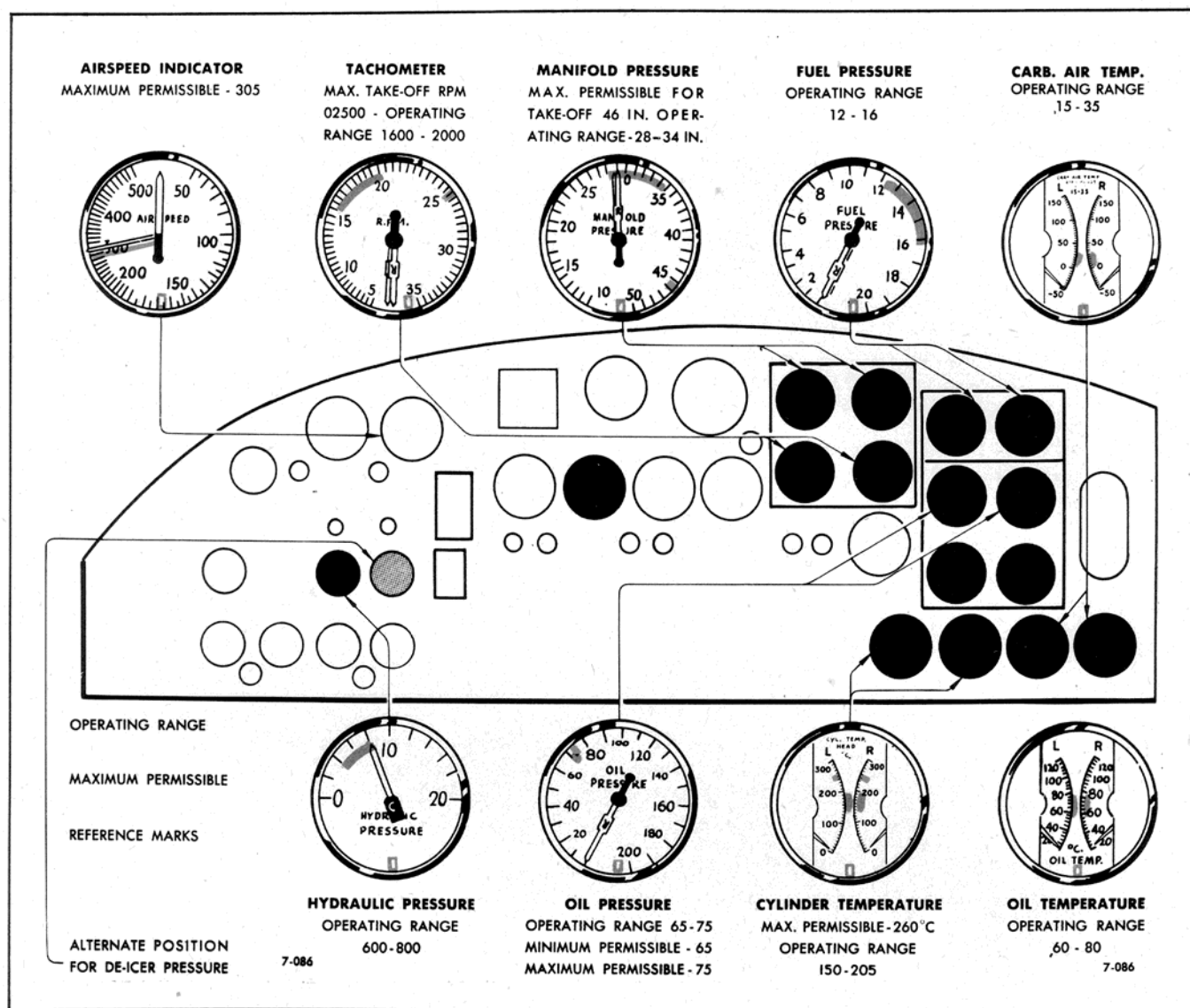


Figure 446—Operating Ranges—Pilot's Instruments

Col Check instruments for broken or loose cover glasses and other visible defects. Particular attention should be given to cover glasses that have been marked to indicate proper operating limits. Mark if necessary.

The white reference line is placed on both the edges of the instrument case and the cover glass. When these two marks are aligned the cover glass is properly positioned.

Clean all instrument cover glasses with a clean cloth. Special care should be taken with individually lighted instruments, as scratches, finger prints, etc., on the cover glasses disturb the lighting.

Check instrument panels for proper movement. Check all instruments for excessive pointer oscillation and for correct pointer position.

Col Check magnetic compass for discoloration of liquid and for evidence of bubbles.

Check the readings of the free air thermometers with atmosphere or hangar temperature thermometer.

Set altimeter to station's altitude, or as directed by pilot.

Set rate of climb indicator to zero, and tap instrument to insure that hand is properly set.

See that air-speed indicator pointer indicates zero, or value of wind velocity component, in direction of aircraft heading.

During cold weather operation below 0°C (32°F) drain the oil pressure gage lines and fill with compass fluid or other suitable low viscosity fluid according to instructions given under 25-hour instrument inspection.

### Fuel System

Col Operate throttle and mixture controls before starting engine to see that they are free.

10 Turn booster pumps "ON" and check fuel pressure at six to 10 pounds per square inch.

Turn switches "OFF" after check.

Check engine primer for leakage in the "OFF" position.

Operate fuel transfer system to check for proper functioning.

Turn the fuel transfer valve handles one complete revolution to assure free operation. Always set the fuel valves by the "click and feel" method.

The fuel transfer pump will not operate unless the valves are correctly turned to one of the three tank positions. See figure 200.

### Lamps and Fuses

Check for proper operation of all landing, passing, recognition, running, trouble, cabin, and instrument lights. Replace any defective lamp bulbs.

Check operation of warning signals.

Check operation of bomber's pilot call.

Replace blown fuses always with a fuse of the same capacity. A blown fuse indicates either a temporary overload or a serious defect. Check equipment and wiring, and repair or replace defective items before replacing the fuse. Keep the spare fuse clips 100 percent full at all times, and *never put a blown fuse in a spare clip.*

With battery switches "OFF," inspect regulator and relay contact points for accumulation of dust.

## DURING ENGINE WARM-UP

### General

Personnel shall be familiar with the correct operation of the engines and controllable propellers. See Section III, paragraph 3.

### WARNING

Do not tow the airplane unless a crew member rides in the pilots' compartment to operate brakes.

### WARNING

If fuel has been spilled during refueling operations, move the airplane a safe distance from that location before starting the engines.

Remove dust excluder plugs from air intake ducts in the leading edge of both wings and from the exhaust stacks before the engines are started. One

Col complete set of dust excluder plugs will be carried with the airplane when operating away from the base, or if the airplane is transferred to another base.

### WARNING

The ignition is grounded through a plug on the forward face of each fire wall. When this plug is "OUT," the ignition is "ON" and the engine is capable of full operation.

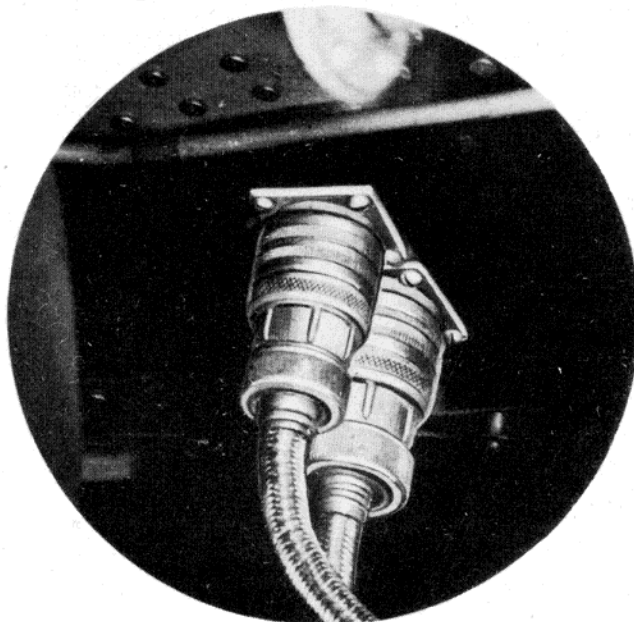


Figure 447—Magneto Plugs Connected

Excepting in an emergency, the engines will not be run on the ground for warming up or testing purposes unless chocks are placed in front of the wheels of the airplane. Engines will not be left running unless a pilot or qualified mechanic is seated in the pilot's cockpit.

### WARNING

If engine fire extinguisher is installed, set selector valve to engine being started. An auxiliary external fire extinguisher should be available nearby. Do not start engine with nacelle cowling removed, as it may then be impossible to extinguish engine fires.

If engines have stood long enough to have cooled, verify that switches are "OFF," and pull propellers through several revolutions by hand in order to pump out accumulations of oil in bottom cylinders. If fuel or oil is present in any combustion chamber, as evidenced by excessive compression, remove the spark plugs from that cylinder, drain all liquid from the cylinder and intake pipes and dry spark plugs thoroughly before replacing. If resistance is met in both directions, check further and determine the cause.



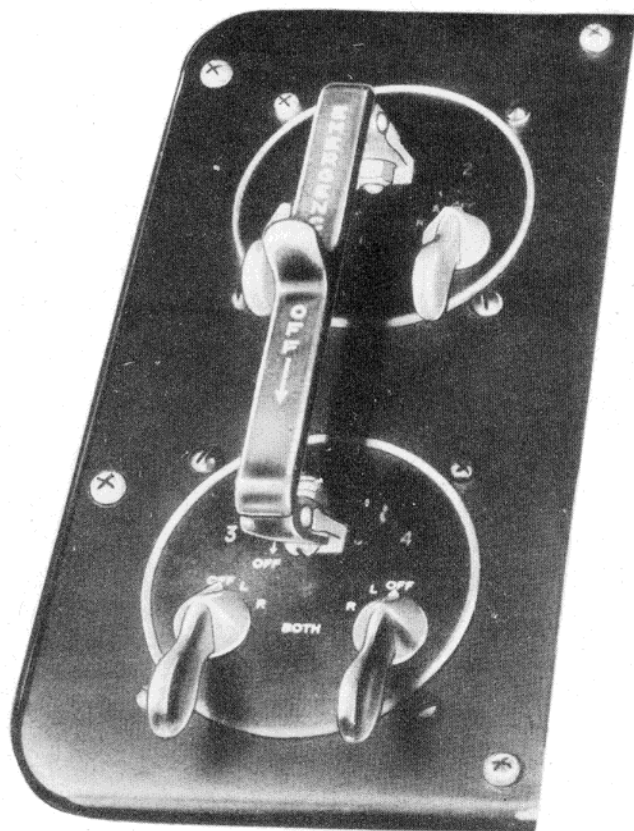


Figure 448—Ignition Switches

Col Start one engine at a time to avoid overloading  
10 the batteries. Suggested engine starting order:  
1-2-3-4.

**WARNING**

During the warm-up period, the engine RPM will not be permitted to exceed one-half of the maximum permissible ground RPM (1000) until after the engine maintains, without fluctuations, at least two-thirds of the minimum full power oil pressure (43.3 lb./sq. in.) and the oil temperature gage shows a definite increase in oil temperature, indicating that oil is circulating properly. When these conditions are obtained, and the mixture and propeller controls are set for takeoff, the engine RPM may be increased to check for proper functioning of the engine and engine instruments at higher RPM; however, the maximum permissible ground RPM (2000) will not be maintained for periods in excess of 20 to 30 seconds. Cylinder temperatures that are beyond the lubricating range of the oil are quickly reached during this period and result in the sticking of pistons or rings; therefore, it is desirable to nose the airplane into the wind during

Col warm-up. Engines will be stopped rather  
10 than idled for prolonged periods after warm-up has been accomplished.

**Engine Instruments**

Check all engine instruments for proper operation and excessive pointer oscillation, and note whether the pointer positions are consistent with the stage of engine warm-up.

The required fuel pressure, oil pressure, and oil temperature are as follows:

<i>Fuel Pressure</i>	Desired	12 to 16 lb/sq in.
	Maximum	16 lb/sq in.
	Minimum	12 lb/sq in.
<i>Oil Pressure:</i>	Desired	70 lb/sq in.
	Maximum	75 lb/sq in.
	Minimum	65 lb/sq in.
<i>Oil Temperature:</i>	Desired	70°C (158°F)
	Maximum	88°C (190°F)
	Minimum	60°C (140°F)

Check the manifold pressure gages by accelerating the engines with the superchargers "OFF," (turbo boost selector at "0.")

The needle should move freely. Check with a barometer, if practicable, and if not operating satisfactorily, check all connections for leaks.

Check the quantity of fuel in each tank with the liquidometer located on the right side of the co-pilot's control panel. Fuel in the outer wing tanks is not recorded by the liquidometer.

**Navigation Instruments**

Check the flight indicator and turn indicator for adequate suction from both vacuum pumps. With the indicator uncaged and the gyro operating under four inches Hg suction, the horizon bar and card should settle to indicate the attitude of the airplane on the ground within five minutes.

Turn on the gyro flux gate compass. Allow 10 minutes for the gyro to come up to speed with the gyro caged. Uncage the gyro. While the aircraft is being taxied into position, observe the indications of the compass system. If the indicators fail to follow the motion of the ship, switch to the alternate inverter. If the indicators still fail to read correctly, inspect the system as outlined in Section IV, paragraph 7. a.

**Ignition and Electrical Equipment**

Check the "OFF" position of the ignition switch for each engine to make sure the magnetos are properly grounded. This check should be made at the end of the engine warm-up period with the propeller in full low pitch and the engine turning

Col over approximately 700 RPM. Turn the switch to  
10 the "OFF" position momentarily and note whether or not the engine stops firing, and immediately return to the "BOTH ON" position. This check is not necessary prior to each flight, but should be accomplished during the preliminary warm-up period at the start of the day's flying.

### WARNING

If the engine does not cease firing when the switches are placed in the "OFF" position, stop the engine by turning off the fuel. After the engine stops, do not touch the propeller until the difficulty has been found and corrected, as the engine may start or "kick over."

Test the ignition timing as follows: With the engine not excessively hot and running at approximately one-third throttle, turn the ignition switches momentarily to "LEFT" and "RIGHT" magnetos and note the loss of revolutions or manifold pressure.

### CAUTION

When checking the magnetos, extreme care must be exercised to prevent engine backfiring. Serious distortion of the turbosupercharger nozzle box can result if backfiring occurs when the wastegate is in a closed or a partially closed position. Therefore, check the magnetos with the turbo boost selector set at "0" and do not switch the magnetos "OFF" at any time during this check.

The normal loss in RPM when operating on one magneto should not exceed 100 RPM. A difference in timing of the two magnetos will result in a difference in loss in RPM, or manifold pressure, when operating on either magneto alone.

### CAUTION

When an engine is operated on only one magneto, as in this check, the manifold pressure must not exceed maximum cruising manifold pressure to avoid detonation when firing on only one set of spark plugs. It is important to switch back to "BOTH," and to leave switch in that position until the engine has picked up the loss in RPM resulting from operating on one magneto, before testing for loss in RPM on the other magneto. This check should be made in as short a time as possible, and should not exceed 15 seconds.

With the generator line switch turned "ON" and the engines running at cruising speed, note if the ammeters indicate "CHARGE."

Col  
10 **Turbosuperchargers**  
See that the turbine wheels are rotating. Check for proper operation of waste gates.

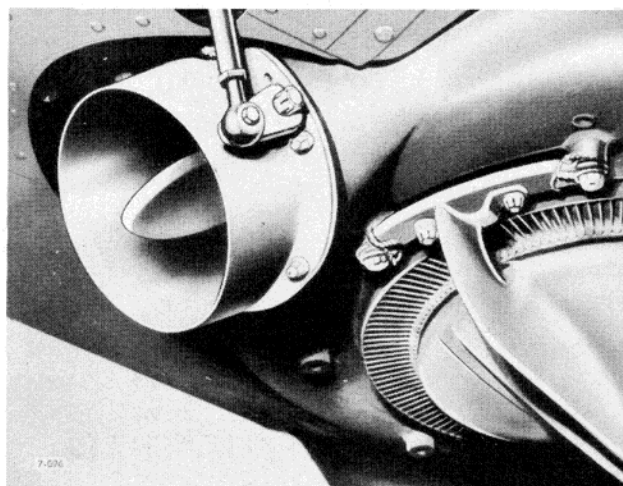


Figure 449—Wastegate—Open

### Propeller and Accessories

Check operation of propeller controls during engine warm-up for full range and free operation. Check the operation of the controllable propeller.

During ground operation, the manifold pressure must not exceed the specific maximum cruising manifold pressure, thus preventing overheating of the engine while operating in the "LOW RPM" (high pitch) position.

If vibration is noted or reported, check the blade angle setting. If necessary, check the track of each blade.

Check the feathering system with the propeller set for 1400 RPM, and have just sufficient manifold pressure to maintain this speed. Depress the feathering switch and note that the engine speed drops. Pull out the switch to release before reaching 1200 RPM.

### WARNING

Do not touch the propeller until the engine has become cool, as the engine may "kick-over" or start, while hot.

### Deicer Equipment

During engine warm-up prior to the first flight each day, the deicer inflating equipment, if installed, will be placed in operation and a careful check made to determine whether all cells of the deicer shoes properly inflate and deflate.

Check the pulsations of the deicer shoes to see that the lines have been correctly connected, according to the cycle given in the figure 356.



Col Check the deicer pressure gage on the instrument  
10 panel. With either inboard engine running at 1500 RPM, it should indicate eight pounds per square inch.

### Oil Filters

Check the operation of the automatic turning mechanism of the engine CUNO OIL FILTERS at least once every 10 hours of engine operation. To do this, install the manual turning nut on the shaft extending through the filter head, in the position for manual turning. Mark one face of the nut, and note the position of this face. Run the engine at idling speed for approximately five minutes, and at the end of that time note the position of the mark on this nut as an indication that the automatic filter-turning mechanism is operating. If the nut has not turned, replace the filter with a clean unit whose operation is known to be satisfactory, and then mark defective unit for overhaul.

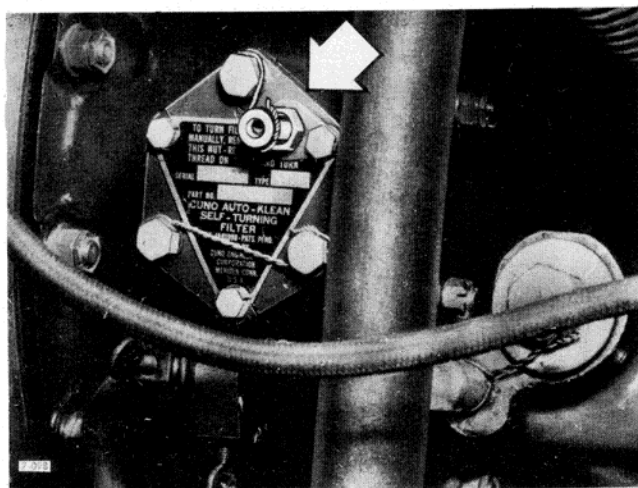


Figure 450—Oil Filter Installation

## AUXILIARY EQUIPMENT

### Life Rafts

If an over-water flight is contemplated, remove the life rafts from their compartments and inspect equipment for completeness and condition.

### CAUTION

The CO<sub>2</sub> cylinder release cable must be disconnected from the raft compartment door latch before pulling the handles in the radio compartment, if it is desired to inspect the rafts without inflating them. Access to the latch is provided through a removable door aft of the raft compartment.

The following accessories will be carried in each

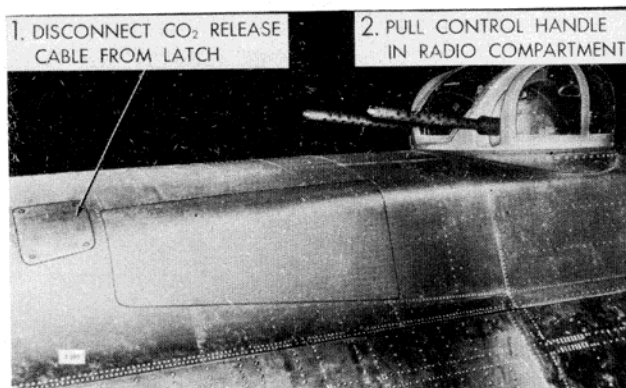


Figure 451—Door Removal—Life Raft Inspection

Col raft in the airplane: Two oars; one hand pump;  
10 one repair kit; 40 feet of 75-pound-test lashing cord; one charged CO<sub>2</sub> cylinder with valve to be connected with raft in readiness for operation at all times. (If any doubt exists as to the cylinder charge it will be determined by weighing. Required weight of charge is stenciled on the valve body of each cylinder.) One bailing bucket is to be stowed in the accessory pocket and one emergency signal kit containing one type M-2 pyrotechnic signal pistol and six type M-11 red parachute distress signals, will be placed in the signal kit bag. When these items have been placed in the signal kit bag, the folds in the top will be cemented down with two coats of rubber cement, Specification AN-C-54. The sealing strip will then be cemented down across the opening with two coats of rubber cement.

Replace all life raft equipment after inspection and reinstall it, with the life raft, in the airplane.

### Note

Regulations require pyrotechnics to be returned to their proper stores when rafts are removed from aircraft.

### Bombing Equipment

## WARNING

The airplane will not be flown with bomb racks removed, as they form part of the primary structure of the airplane.

All bombing equipment should be inspected as necessary, depending on the service use. This inspection shall include a thorough check of the bomb rack and controls and bomb rack indicator system, to assure correct operation at all times. Check for proper sequence of release as given in Section IV, paragraph 7. d. (3). Bombs are released

Col either mechanically or electrically. When released  
10 mechanically, the bombs should be "SAFE" and  
when released electrically they should be  
"ARMED" (Cable & Rod Control only).

#### IMPORTANT

Be sure that the bombardier's indicator  
lights go out as the respective stations  
are released.

Remove the shackles from the bomb rack and  
check the shackle assembly for cleanliness. If an  
appreciable amount of foreign substance is found,  
clean with kerosene but do not lubricate. Check  
the operation of the moving parts for freedom  
from binding. Inspect the shackle for synchroni-  
zation of the arming and release mechanisms with  
the arming and release controls at the bombardier's  
station.

Make a visual inspection of each shackle frame,  
carrying hook and arming and release lever for  
any binding, warping, or wearing of these parts.

With the shackle in the "LOCKED" position,  
check for good engagement of the releasing lever  
with the pawl, and of the pawl with the stop in  
the link assembly. Holes in the frame are pro-  
vided for this check.

With the release units and shackles in place, the  
bomb doors closed, and the bombardier's release  
handle in "LOCK" position, operate the pilot's  
emergency bomb release control.

#### CAUTION

When the airplane is on the ground,  
make certain that all personnel and ob-  
structions are clear of the bomb bay  
doors before the door control handle is  
operated.

It may be necessary to simulate flight conditions  
by forcing the doors to the fully open position in  
order that the mechanical interlock, operated by  
the left door, may allow emergency tripping of  
the release units. The interlock should release the  
bomb mechanism when the inboard edge is ap-  
proximately 4-1/2 inches from the fully open posi-  
tion. The bomb door safety switch should close  
at approximately the same time that the mechani-  
cal interlock releases the bomb control mechan-  
ism. Operation of the switch should be deter-  
mined by observation of the bomb door signal  
lamp on the bombardier's control panel.

Run the bomb door retracting mechanism to the  
"OPEN" position and check for re-engagement  
with the doors. (On airplanes equipped with rod  
operated bomb controls, make sure that the "dog-  
leg" segment of the controls below the cabin floor

Col is returned to the normal position. On airplanes  
10 equipped with cable operated bomb controls, be  
sure that the "emergency rewind wheel" on the  
bombardier's control stand is rewound.)

Reset the release units, retract the bomb doors,  
and repeat the procedure with the bomb bay  
emergency release handle.

#### CAUTION

Bomb rack and control system parts  
should not be greased or oiled at any  
time. When necessary to clean the rack,  
it should be accomplished by the use of  
kerosene, U. S. Army Specification VV-  
K-211. The rack will be cleaned when-  
ever inspection shows it to be necessary.

#### Gunnery Equipment

Inspect all flexible gun platforms and turrets for  
general condition, security of mounting, and gen-  
eral cleanliness. If possible, ammunition in the  
upper turret should be assembled with type M-2  
extra flexible links.

Check turrets and mounts for free rotation and  
ease of operation.

Check for presence of emergency crank and  
wrench handles inside and outside of the lower  
ball turret.

Check the firing limits of the turret guns. For  
boresighting instructions see Section IV, para-  
graph 7. d. (3).

Check feed boxes and ejection chutes for proper  
alignment.

Check oxygen supply in the lower ball turret.

Check glass in turrets for chipping and cracks.

Clean all *Plexiglass* and *plate glass windows* in  
gun turrets.

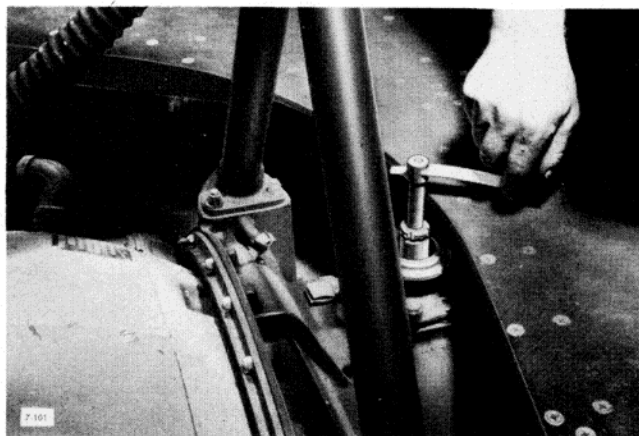


Figure 452—Emergency Crank—Ball Turret



Col Check the hydraulic power unit reservoirs in  
10 the upper local and lower ball turrets through the sight gages for proper fluid level. Each reservoir contains approximately 2 U. S. (1.7 Imperial) quarts. Fill if necessary with hydraulic fluid Specification AN-VV-O-336.

Inspect chin turret as follows:

Check screws holding movable housing to support arms.

Check gun slot zippers.

Check all AN plugs at resistor box, sight, azimuth and elevation motors and controller, firing solenoids and charger valve.

Check azimuth and elevation flexible shafting, leading from speed reducers, to sight.

Check hydraulic charger valve. (Installed on early B-17G's only).

Check firing solenoids.

Check ammunition feed mechanism.

Check guns in accordance with Air Corps procedure.

Check both filaments of sight lamp.

Check up and down elevation limits.

Check azimuth clockwise, and counter-clockwise limits.

Check trigger switches.

Check high speed switches.

Remove the protective gun sleeve covers from all guns.

#### CAUTION

Excessive lubricant should be removed from all moving parts to prevent unsatisfactory operation at high altitudes.

#### COMMUNICATION EQUIPMENT

Test mechanical ease of operation and absence of excessive mechanical looseness of controls on all equipment with all receivers turned on and tuned to a signal. Check for presence of undesired dynamotor overload, indicated by low RPM. Turn off equipment after test.

COMMAND SET SCR-274-N.  
PILOT'S POSITION.

Make receiver operating test on "CW" and "VOICE," with "INCREASE OUTPUT" control turned fully clockwise while tuning through the entire band (all receivers except the one being tested should be turned off), observing:

Col Signal strength of a known station, interphone  
10 jack box volume control fully on.

Presence of undesirable oscillations.

Presence of undesirable noise.

Accuracy of dial calibration.

Action of gain control.

Leave volume control fully counterclockwise, low frequency receiver turned on, for further tests of other equipment.

Make transmitter operating test of each transmitter, observing presence of side tone on each transmitter. Leave transmitter turned on for "VOICE" operation for further tests on other equipment.

FILTER SWITCH BOXES BC-345 or FL-8.

Test for rejection of radio range code signals on "VOICE" position.

Test for rejection of voice signals on "RANGE" position.

Test for presence of radio range and voice signals on "BOTH" position.

COMMAND RADIO SET, SCR-522 (if installed.)

Make an operating test on both the receiving and transmitting components, observing:

Receiver output with low frequency SCR-274-N receiver volume fully counterclockwise.

Presence of extraneous receiver noises with engines running.

Proper modulation of transmitter section on any one band. (Check with ground station or another airplane.)

Turn off SCR-522-A. Turn low frequency SCR-274-N receiver volume control fully clockwise and leave for further tests on other equipment.

RADIO COMPASS SET SCR-269-G.

#### Note

Airplane should be located at least 200 feet from any large electrically conductive objects.

Make operating test on "ANT" observing:

Operation of control position light.

Action of tuning meter.

Action of lamps control and operation of all dial lights.

Col Presence of spare lamps.

10 Action of audio control.

Signal strength of a known station, interphone jack box volume control fully on.

Accuracy of frequency dial calibration.

Make operating test on "LOOP," observing:

Presence of signal.

Action of loop-drive control.

Make operation test on "COMP," observing signal strength and directional indication of the compass indicator pointer when a known station is tuned in on each band. Return switch to "ANT" position, tune in signal, and leave volume control fully clockwise for further tests on other equipment.

#### INTERPHONE JACK BOX AT PILOT'S AND COPILOT'S POSITION.

Test for presence of command receiver output on "COMMAND" position and operation of volume control.

Test for presence of voice on "INT" position.

Test for presence of voice on "CALL" position.

Test for presence of compass receiver output on "COMP" position.

Test for presence of liaison receiver output on "LIAISON" position.

Test headset and microphone cords for intermittent contact.

#### RADIO OPERATOR'S POSITION LIAISON RADIO SET SCR-287.

Make receiver operating test on "MCV," with a minimum setting of volume control on all bands, observing:

Operation of dial lights control.

Action of "AVC."

Presence of audible beat note with "CW" oscillator switch on, and variation of pitch when beat frequency adjustment is changed.

Action of crystal filter with the "CW" oscillator switch on.

Presence of excessive noise with engines running.

Align antenna for maximum signal input on approximately 500 kilocycles. Leave receiver turned on, signal tuned in, volume control fully clockwise for further tests on other equipment.

Make transmitter operating test.

Connect to external power source or start auxiliary power plant before making extensive tests on

Col transmitter if engines are not running. Otherwise, tests should be of extremely short duration.

Place 24-volt/28-volt switch in the tube compartment on the appropriate position, depending upon the voltage of the power source.

Observe all meters for abnormal readings with emission switch on "CW" and "VOICE."

Place 24-volt/28-volt switch in tube compartment in 28-volt position for flight operation.

Lock tuning controls.

#### RADIO SET SCR-595-A OR SCR-695-A.

Make an aural test (with head set plugged into the phone jack of the control box) to determine the presence of undesired self-oscillations.

Locate properly adjusted test transmitter near the antenna and make an aural check with the head set plugged into the phone jack of the control box. The characteristic signal produced by the test transmitter and radio set should be heard clearly. Care must be taken to insure that the test transmitter signal is being heard and not some unwanted oscillations from other sources.

Make an aural test of the operation of the "EMERGENCY" switch.

Before inserting the destroyer plug into the receiver, check for presence of unwanted voltage at the destroyer plug terminals.

Subject the inertia switch to light jarring and check for proper centering of reset plunger and indication of warning lights before inserting the destroyer plug.

#### ANTENNA REEL RL-42.

Throw the reel control box switch to the "OUT" position and check operation of reel. Wire should reel out until the weight touches the ground.

Throw the reel control box switch to the "IN" position and check operation of reel. Warning light should be on at any time the wheels are not in retracted position or at any time the trailing antenna wire is out.

Reset indicator to "000" if necessary.

#### INTERPHONE JACK BOX.

Test for presence of command receiver output on "COMMAND" position and operation of volume control.

Test for presence of voice on "INT" position.

Test for presence of voice on "CALL" position.

Test for presence of compass receiver output on "COMP" position.

Test for presence of liaison receiver output on "LIAISON" position.



- Col** **Note**  
10 Test headset and microphone cords for intermittent contact.

**NAVIGATOR'S POSITION.**  
**RADIO COMPASS SET SCR-269-G.**

Airplane should be located at least 200 feet from any large electrically conductive objects.

Make operating test on "ANT," observing:

Operation of control position lights.

Action of tuning meter.

Action of lamp control and operation of all dial lights.

Presence of spare lamps.

Action of audio control.

Signal strength of a known station, interphone jack box volume control full on.

Accuracy of frequency dial calibration.

Make operating test on "LOOP," observing:

Presence of signal.

Action of loop-drive control.

Make operating test on "COMP," observing signal strength and directional indication of the bearing indicator pointer when a known station is tuned in on each frequency band.

**INTERPHONE.**—Check the operation of the interphone jack boxes, type BC-366, at each crew station.

Test for presence of command receiver output on "COMMAND" position and action of volume control.

Test for presence on "INTER" position.

Test for presence of voice on "CALL" position.

Test for presence of compass receiver output on "COMP" position.

Test for presence of liaison output on "LIAISON" position.

Test for presence of intermittent contacts when interphone jack box and associated plugs and cordage are subjected to jarring.

Turn off all equipment, unless crew members are at their station, ready for take-off.

### Photographic Equipment

#### Note

The preflight inspection is a check of the camera mount supports, camera ports, etc., prior to the first flight of the day, and is designed to ascertain that the camera and its accessories can be readily mounted and satisfactorily used in the

- Col** airplane. The inspections listed will be considered to be the minimum required.

Inspect camera mount supports for cleanliness, ease of adjustment, and proper engagement of locking pins.

Check to see that the camera door and viewfinder openings will open and close properly.

Check the camera power circuit.

Check the holes and slots in the viewfinder mounting ring.

Clean the floor and the inside and outside surfaces of windows below camera position.

### INSPECTIONS AFTER FLIGHT

#### Oil Dilution

Idle the engines until the temperature falls to about 40°C (104°F). Run engines at 1000 to 1200 RPM. It is impossible to dilute the oil unless the engines are running.

Maintain an oil temperature of less than 50°C (122°F) and an oil pressure above 15 pounds per square inch. If oil temperature rises or oil pressure falls beyond these limits, shut down and allow engines to cool.

If the airplane has an automatic dilution switch installed, dilute as instructed on the placard.

If the airplane has the manual dilution switch, hold the switch in the "ON" position for the period given below. At the end of the period, stop the engines, keeping the switch on until the engine stops.

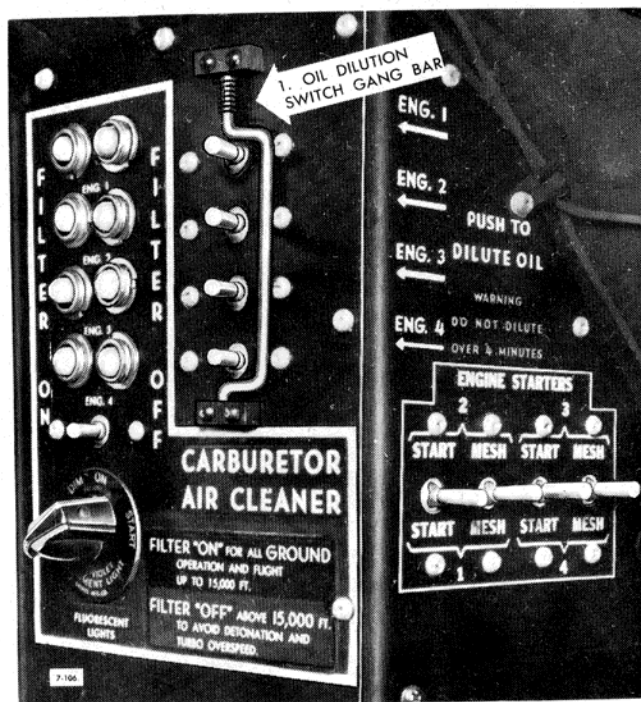


Figure 453—Oil Dilution Switches

<i>Col</i> 10	<i>Dilution Time Minutes One period</i>
<i>Anticipated Lowest Outside Air Temperature</i>	
4° to 12°C (40° to 10°F)	2
-12° to 29°C (10° to 20°F)	5
-29° to -46°C (20° to -50°F)	7

For each 5°C (9°F) below -46°C (-50.8°F), add one minute to the time given.

During the last two minutes of the dilution period, operate the propeller pitch controls slowly and continuously from "HIGH RPM" to "LOW RPM".

Proper operation of the dilution system is indicated by a considerable drop in fuel pressure. If the fuel pressure does not fall off, investigate the dilution system.

A complete redilution of the engine is required only after 1/2 hour or more of operation at normal oil temperature, as this is the time required to boil off the gasoline.

If it is necessary to service the oil tank, split the dilution period in half and service between the two periods.

#### Parking

Lock the surface controls.—The rudder and the elevators are locked by raising the locking lever, recessed in the floor, aft of the engine control stand, adjacent to the pilot's seat. The ailerons are locked by inserting a pin through the proper holes in the pilot's wheel and column.

Lock the tail wheel by lowering the locking lever recessed in the floor, aft the engine control stand, adjacent to the copilot's seat.

Set the parking brakes.

#### CAUTION

Allow the brake drums to cool thoroughly before setting the parking brakes, in order to prevent damage to the rubber brake expander tubes.

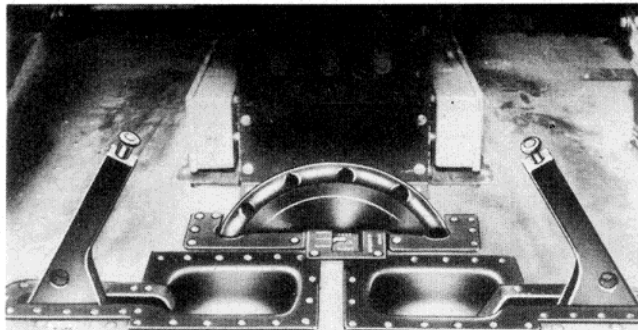


Figure 454—Parking Brakes and Surface Control Locks

*Col* 10 Moor the airplane, following instructions in Section III, paragraph 2.

Install air speed tube head protection covers.

Canvas protective covers for the chin turret, cockpit enclosure, upper local gun turret, lower ball gun turret and tail gunner's emplacement, should be installed, particularly in areas subjected to high winds, high humidity and extreme temperatures.

#### Oxygen Equipment

After the last flight on each day in which the use of oxygen equipment has been involved, all oxygen masks used in such flights will be cleaned thoroughly by washing all parts of the mask with a lather made from a good quality facial soap and warm water. The mask will then be thoroughly rinsed with clean water and dried. Check the pressure gage at each crew station to determine the contents remaining in the system. Refill the system if it does not contain sufficient oxygen for another mission.

#### Fuel and Oil Tanks

All fuel and oil tanks will be serviced to the full normal supply and the quantities entered on Form No. 1A at completion of the day's flying. Refer to servicing instructions, section III, paragraph 2.

#### Note

Self-sealing tanks must be kept filled when the airplane is on the ground to prevent their collapse.

Visually inspect airplane while servicing.

#### Hydraulic System

Check for the proper fluid level in hydraulic reservoir and fill if necessary with the specified fluid. See section III, paragraph 2., for servicing instructions.

#### Landing Gear

The exposed part of the piston tube of all landing gear shock strut cylinders which are not covered by protective boots, will be wiped free of ice, mud, dust or sand by means of a cloth saturated with the same kind of hydraulic fluid used in the strut.

#### Generator Brushes

Generator brushes will be inspected for wear after each flight at altitudes of 20,000 feet or higher.

#### Heating System

The filter handle in the glycol heating system will be turned after every flight.

#### Propellers

At the end of the day's flying, clean the propeller and inspect and coat with clean lubricating oil, Specification No. AN-VV-O-446. Coating the pro-



Col 10 peller blades and hubs with engine oil protects the exposed propeller surfaces from rust and corrosion. The oil seeps into cracks that may exist in the blade or hub, making otherwise obscure cracks visible. Exposed surfaces of propellers installed, but not in daily use, will also be coated with clean engine oil as often as required to prevent corrosion.

If propeller anti-icer equipment has been used, thoroughly wash propeller hubs, blades and slinger rings before applying lubricating oil for protection. Inspect for dripping of anti-icer fluid.

If leakage occurs, it will be necessary to inspect the outlet line check valve for malfunctioning.

### Engine Sections

Sufficient cowling will be removed to check for fuel and oil leaks within the engine sections, for failures of wires, lines and connections, and for secure attachment of exhaust pipes and collectors.

### Communications Equipment

#### Note

If there was no operator on the flight, the radio mechanic making the inspection will check with the pilot upon landing to get his personal report on performance of the equipment.

Check Form 1A for entries pertaining to communications equipment.

Check any defect noted, and indicate, by appropriate entries, corrective action taken.

Make visual inspection of antennas, all communications equipment, and associated wirings.

### Gunnery Equipment

Clean the guns in all turrets and install the protective gun sleeve covers.

Check the gun turrets and mounts for free rotation and operation.

Check the glass and plexiglas in the gun turrets for chipping and cracks.

Clean the machine guns.

Check the operation of the machine guns and the harmonization of the gun sights.

Remove the groups.

Check to see whether or not there is any ammunition remaining in the ammunition boxes.

Check the ejection chutes for any jams.

Detail strip the groups.

Check the gun parts for wear, burrs and breakage.

Clean and oil the gun mechanism and the barrel bore, as instructed in applicable ordnance orders.

Col 10 When guns are being serviced to be fired in the air, observe the following rules:

All gun components must be assembled in the gun.

The gun components must be correctly assembled. Special attention must be paid to the position of the rear and front cartridge stop, the belt feed slide components, belt switch, and the belt feed lever.

The oil buffer must be full of oil, U. S. Army Spec. 2-36, and the arrow on the buffer should point 1/8 inch below the "0" position on this buffer body, to obtain the highest rate of fire.

The whole gun mechanism must be oiled *sparingly*, with machine gun oil, AAF Specification No. AXS-777.

Any trace of oil or dirt must be removed from the barrel bore.

The headspace of the gun should be checked.

The gun firing solenoid must be adjusted so that it will release the firing pin when the barrel extension is at .040 from battery position but not when the barrel extension is at .116 from battery positions. Best results are obtained when the gun fires between .080 and .090. (*See applicable ordnance instructions.*)

### Bombing Equipment

Check bomb bay doors for condition and for proper operation.

Check bomb racks for any bombs remaining in the racks.

Inspect bomb rack controls for proper positioning.

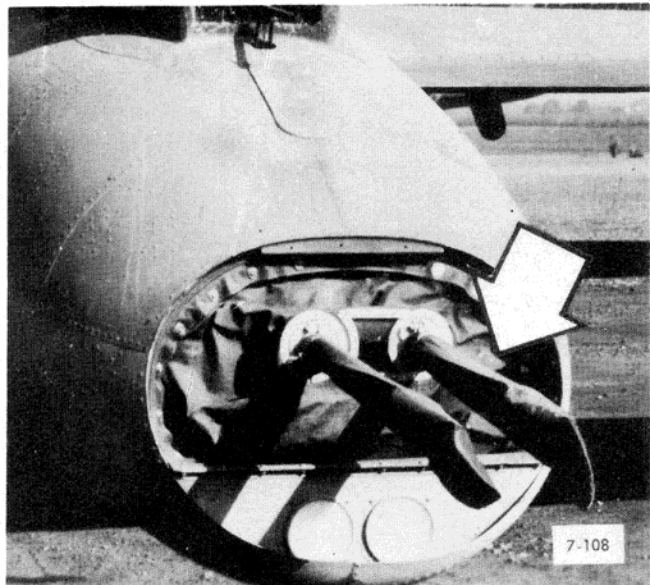


Figure 455—Cover Installation—Tail Guns

## DAILY INSPECTIONS

*(To be performed at any time during the day)*

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19

### Propellers and Accessories

In case the airplane is not to be used for several days, the propellers will be feathered and unfeathered. Checking of the feathering and unfeathering controls will be accomplished with the engine stopped and the engine sump drain plug removed so that the oil pumped from the propeller will not collect in the engine crankcase. This check will be made after the engine has been operated and the required oil temperatures have been reached. Upon completion of the feathering and unfeathering cycle, the engine sump drain plug will be reinstalled and the oil system serviced. This procedure is recommended in order to remove deposits of carbon or sludge from the propeller control system, thereby eliminating the possibility of corrosion of the parts during the period of idleness.

### Engine Section

#### WARNING

The ignition is grounded through a plug on the forward face of each fire wall. Removal of this plug leaves the ignition on. The propeller must not be removed when the ignition plug is out.

Remove engine cowling except ring cowling.

Inspect the engine ring cowling for security of attachment and safetizing of turnbuckles. The cowling must not be excessively tight when engine is cold.

Inspect exposed portions of engine mount and mounting brackets for general condition and security of attachment.

See that cowling is not rubbing cooling fins.

Check for broken or damaged baffles.

See that cowl flaps operate to extreme positions—full open to full closed—within two to five seconds.

Inspect engine for evidence of throwing oil.

Inspect for proper safetizing of all drain plugs, covers, etc.

Inspect exhaust manifolds for security of attachment; missing nuts, bolts, lugs, etc.

Inspect intake pipes for security of attachment and leaking gaskets.

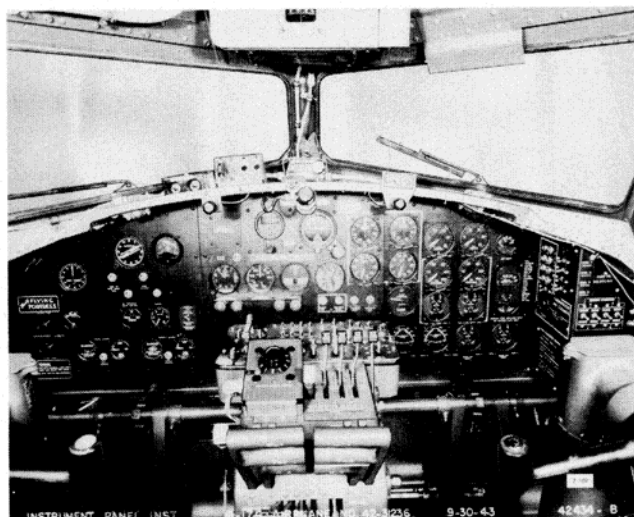


Figure 456—Engine Control Stand

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### Engine Controls

Inspect throttle, propeller, mixture and inter-cooler control assemblies for proper functioning, operating range, tightness, safetizing and for general condition.

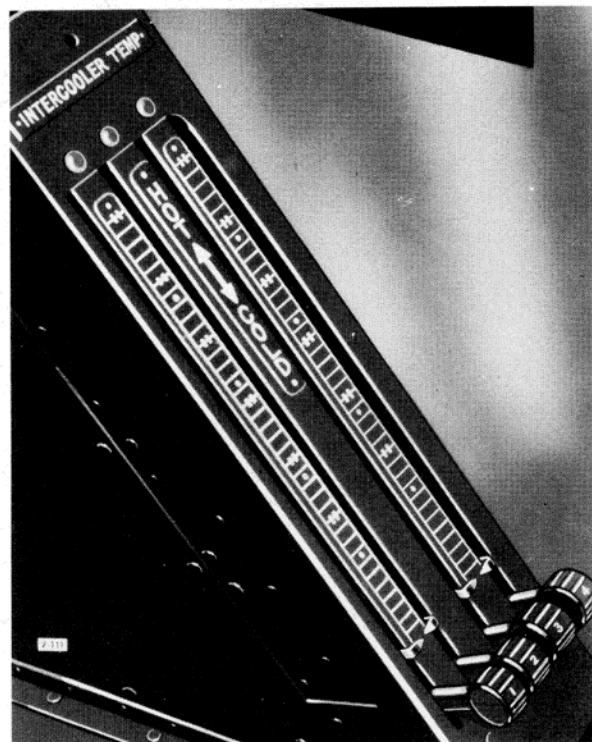


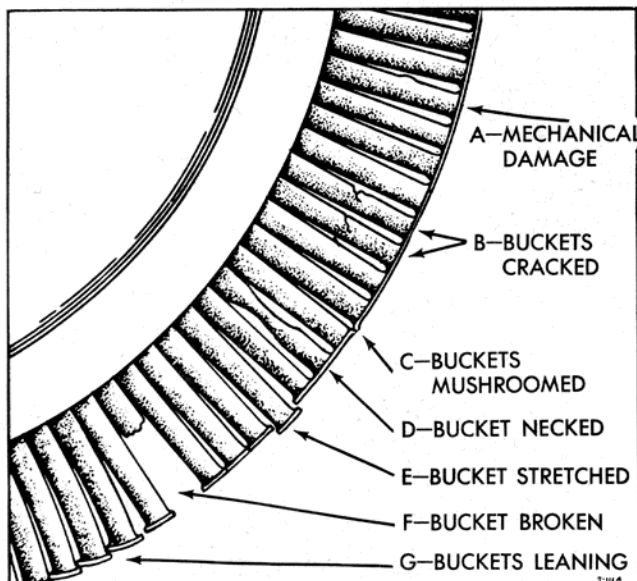
Figure 457—Intercooler Temperature Control



Col  
19**Turbosuperchargers**  
**(Type B-2 and Type B-22)**

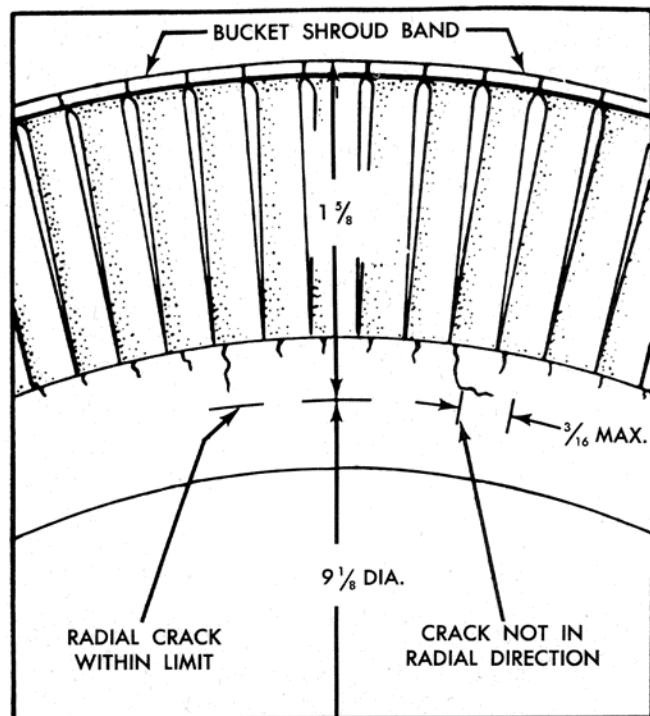
Inspect bucket wheels. (Refer to figure 458.) Nicks, dents, or gouges caused by foreign materials coming in contact with buckets (A), necessitate removal of the turbosupercharger. Cracked buckets (B), are cause for removal. Mushrooming (C), will not be cause for removal of the turbosupercharger unless it has progressed to the point where the end of the shroud is cracked or broken. In welded wheels, necking of the bucket occurs only in the blade (D), and is cause for removal of the turbosupercharger. In dovetailed wheels, necking of the bucket may occur in the blade or it may be localized in the neck of the bucket. Any bucket showing this defect is cause for removal of the turbosupercharger. When stretching of the buckets has progressed to the point where the shroud of a bucket extends beyond the shroud of adjacent buckets (E), the turbosupercharger must be removed. Broken buckets (F), are cause for removal of the turbosupercharger. Leaning of the buckets (G), is not cause for removal of the turbosupercharger unless the shroud of one bucket overlaps the shroud of the following bucket.

Thoroughly inspect the nozzle box visually for any cracks, especially in the weld, or for evidence of deterioration. The inside of the nozzle diaphragm can be inspected by projecting a flashlight beam into the clearance between the nozzle diaphragm and the bucket wheel and looking

**Figure 458—Bucket Wheel Inspection Diagram**

Col 19 through the space between the buckets. If any cracks more than one inch long are observed in the nozzle diaphragm, or if any cracks are observed in the walls of the nozzle box which would result in leakage, the turbosupercharger must be replaced. Look between buckets of turbine wheel and nozzle diaphragm for buckling of nozzle blades, especially toward the wheel. If such occurs, the turbosupercharger is to be replaced.

Inspect welded wheels for cracks which are cause for removal of turbosupercharger: Radial cracks which extend into the wheelblank metal within a circle of 9-1/8-inch diameter, or, when measured from the shroud band, do not extend inward toward the shaft more than 1-5/8 inches. Cracks which extend in other than a radial direction must not progress more than 3/16 inch circumferentially even though these cracks are outside the minimum 9-1/8 inch diameter circle, or inside the 1-5/8 inch radial line from the shroud band.

**Figure 459—Cracks in Welded Wheel**

Inspect the induction system for leaks. Start up the engine and obtain take-off manifold pressure by use of the turbosupercharger. Then shut off the engine, taking care to completely close the throttle. While the turbosupercharger is still revolving, place a smoke rag at the air intake scoop of the induction system so that the smoke will be drawn into the manifold system by the turbosupercharger rotor. While the smoke is being introduced into the system, check to see if any smoke comes out of the inter-cooler cooling air intake

Col or exit. If any smoke comes out of these openings,  
19 it indicates a leak in the intercooler core. Also check as much of the ducting and flange connections of the air induction system as practicable for smoking leaks. Repair or replace parts as necessary to eliminate any leaks discovered. Any major leak in the intercooler core requires replacement of the intercooler.

Inspect the bucket wheel disk directly below the cooling cap rim for run-out by revolving the bucket wheel slowly by hand. Also look for evidence of cracks or distortion. If the run-out is greater than .005 inches, or any crack in the wheel disk is observed, the turbosupercharger must be replaced.

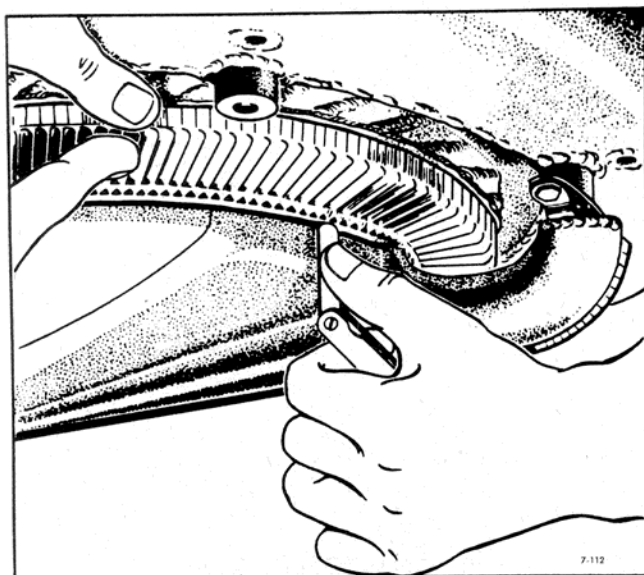


Figure 460—Checking Bucket Wheel Run-Out

#### Air Filters

Inspect filters daily for contamination and proper lubrication.

If inspection reveals evidence of dirt or insufficient lubrication, remove and clean as follows: Wash in gasoline or other suitable volatile cleaning fluid. While cleaning, rock the filter element or agitate the cleaning fluid to insure removal of dirt from the innermost part of the element. Thoroughly dry filter element.

Immerse from two to five minutes in a mixture composed of *one* part corrosion preventive compound Specification No. AN-VV-C-576, and *three* parts lubricating oil, Specification No. AN-VV-O-466, Grade 1120.

Drain element from two to four hours to remove excess oil prior to installation.

#### Note

It is imperative that, after washing in gasoline or volatile cleaning fluid, the

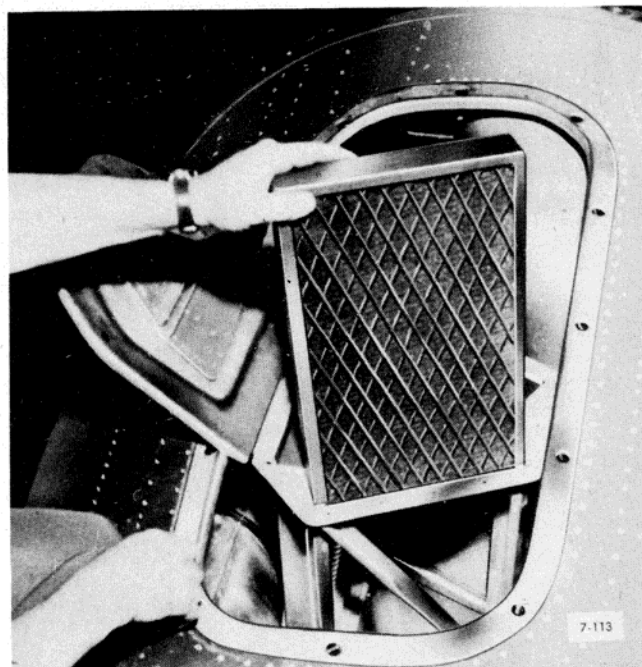


Figure 461—Carburetor Air Filter Removal

Col element be thoroughly dried prior to im-  
19 mersing in oil; otherwise the air filter will not be properly coated, resulting in impaired cleaning efficiency.

#### CAUTION

Under extremely dusty conditions, inspect and clean all carburetor air filters after each flight.

#### Fuel System

With the fuel booster pumps on, inspect carburetor and fuel line connections for leakage, particularly at drain plugs, passage plugs, and parting surfaces of body castings.

Check primer for leaks when in the "OFF" position.

Inspect carburetors for proper safetying.

Inspect fuel pumps for security of mounting and for safety wiring.

The fuel system has been treated for use of aromatic fuels and will be checked for correct and discernible markings every 30 days.

#### Oil System

Drain any water from the oil tank sump drains.

In cold weather, it may be necessary to heat sump to obtain satisfactory drainage.

Inspect all drain plugs, drain cocks and connections for tightness and proper safetying.



- Col* Inspect oil temperature regulators for security of mounting and for proper blanketing if necessary to maintain sufficient "oil-in" temperature in extremely cold weather.

### Ignition and Electrical Equipment

The operation of the various parts of the starting, ignition, and electrical systems is checked when starting and warming up the engines together with the preflight inspections. If the operation is found to be unsatisfactory, detailed inspection will be made to determine the cause of unsatisfactory operation.

Inspect starters, generators, switches, and solenoids for cracked housings or flanges, security of mounting, tightness of housing bolts, and safetying of all attaching or connecting bolts. Replace faulty equipment and tighten or safety, mounting bolts as required.

Inspect parting surfaces of starters for evidence of oil in starter gear cases or around fly wheels. The presence of oil in a starter gear case often results in starter failure, particularly in cold weather. When, on inspection, this condition is found, the starter should be removed and replaced with one from stock.

Check induction vibrators for operation by turning off ignition switch and depressing starter "MESH" switch for engine affected. Listen at nacelle firewall for buzzing of vibrator coil.

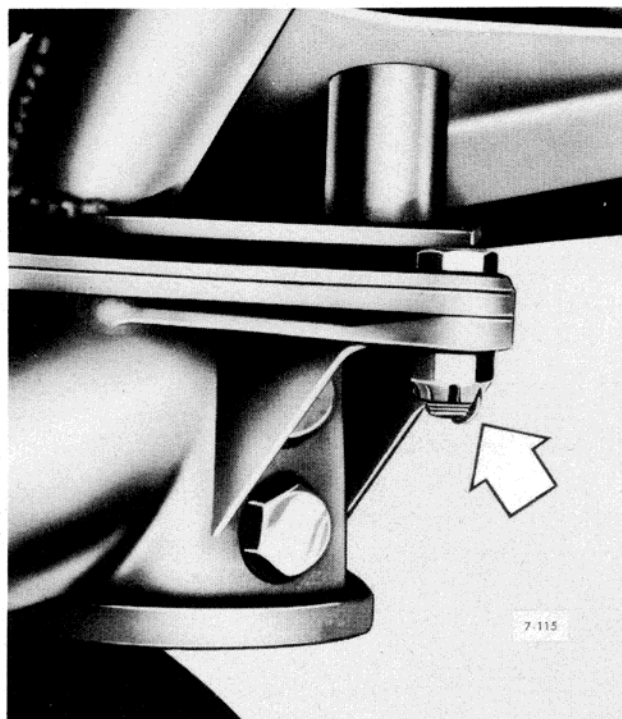
Replace engine section cowling and check for security of attachment.

### *Col* Main Landing Gear

- 30 Make visual inspection of landing gear. Inspect tires for proper inflation, general condition, cuts, pulling away from rims, and evidence of interference or chafing against other parts. Inspect air-oil shock absorber struts for proper inflation and for evidence of fluid leaks or loss of pressure, as evidenced by abnormal deflection. See diagram in preflight inspection, this section. Inspect landing gear linkage for security of attachment and correct alignment. Inspect general condition of struts, drag links, retracting mechanism, fittings, and braces. Inspect wheels for freedom from mud, grass, ice, foreign matter, etc., for distorted rim flanges and ribs, for security of retaining nut, bolts, and cotter pins, and for security of lock rings.

### Tail Landing Gear

Inspect tail wheel assembly for freedom from mud, grass, ice, foreign matter, etc., for worn or loose anti-shimmy brake shoes, and for condition of shock unit; determine whether tail is supported in proper position.



**Figure 462—Tail Wheel Shear Bolt**

- Col* Inspect air-oil shock absorber strut for evidence of fluid leakage or loss of pressure.

Inspect for proper inflation of the tail wheel tire. Inspect shear bolt. If it has been sheared, it must be replaced with 1/2-20 x 1-3/8 24ST bolt (AN8-DD-13).

Inspect tail wheel boot for general condition.

### Hydraulic System

Inspect hydraulic units for leakage and replace packings as soon as leakage develops. If external power is available, build up the pressure in the system (800 pounds per square inch) and check gage readings and operation of all units.

Turn the handle of the hydraulic filter one complete revolution in each direction. (Turn, also, at least once during the first hour of operation after hydraulic system overhaul or fluid change.)

### Instruments

#### CAUTION

Always be sure that switches and power are off when working on electrical instruments. When disconnecting fluid operated instruments, plug lines immediately to prevent loss of fluid.

Check all instruments for loose, or broken cover glasses. Cement loose cover glasses with aircraft instrument sealing compound, U. S. Specification No. 2-87.

Check magnetic compass for discoloration of the liquid and for evidence of bubbles. All compasses

*Col* will be compensated and the readings recorded  
30 at each change of engines or other equipment likely to affect them, or at least once during each three-month period. If at any time the compass is suspected of being in error, it will be checked and if necessary, compensated; see *100-Hour Inspection*, Column 44, for instructions for swinging compasses.

#### Communications Equipment

GENERAL.—Check Form 1A for remarks pertaining to communications equipment. Correct any defect noted and not previously corrected and indicate, by appropriate entries, corrective action taken.

#### INSPECTION OF ANTENNAS.

Check shock links and springs for tension and deterioration.

Check antenna wire for nicks. Replace any antenna found defective.

Check marker beacon antenna lead-in nut for tightness.

Check insulators for chipped, cracked, or dirty condition.

#### VISUAL INSPECTION.

Check to see that all equipment is properly secured.

Check all cordage and plugs.

Check for correctness of T. O. No. 08-15-1 Radio Facility Charts (current monthly issue) and for presence of other required T. O. of the 08-15 series and Technical Order Instruction Books for installed communications equipment.

OPERATING INSPECTION.—Test mechanical ease of operation and absence of mechanical looseness of controls on all equipment checked during the operating inspection. Check for presence of undesired dynamotor overload, indicated by low RPM. Turn off equipment when tests are completed.

#### PILOT'S POSITION.

##### COMMAND SET.

Test receiving operation "CW" and "MCW" on all bands, full and reduced volume, observing:

Signal strength of a known station, interphone jack box volume control full on.

Operation of auxiliary control circuit with signals of maximum volume.

Presence of undesired oscillations.

Presence of excessive noise.

Accuracy of dial calibration.

Action of gain control.

*Col* Over-all sensitivity throughout all bands.

30 Undesired presence of intermittent contact when control box and associated plugs and cordage are subjected to jarring.

Leave low frequency receiver on, volume control fully counterclockwise and transmitter on "VOICE" for further tests on other equipment.

Make transmitter operating test of each transmitter, observing:

Presence of side tone on each transmitter.

Undesired presence of intermittent contacts when the transmitter control box and associated plugs and cordage are subjected to jarring.

#### FILTER SWITCH BOXES.

Test for rejection of radio range code signals on "VOICE" position.

Test for rejection of voice signals on "RANGE" position.

Test for presence of radio range and voice signals on "BOTH" position.

Test for presence of intermittent contacts when filter switch box and associated plugs and cordage are subjected to jarring.

#### COMMAND RADIO SET SCR-522-VHF.

Test receiver output with low frequency SCR-274-N receiver volume control fully counterclockwise.

Check for presence of extraneous receiver noises, with engines running.

Check for proper modulation of transmitter section on any one band. (Check with ground station or another airplane.)

Check for intermittent contacts, receiver operative, while subjecting transmitter-receiver chassis, dynamotor, and cordage to jarring.

Open transmitter cover and plug Test Set I-139-A into transmitter meter socket. Turn meter switch to number 3 position.

Push lowest frequency channel button, and allow a two-minute warm-up period.

Record the meter reading in the service log in the manner prescribed in Technical Order No. 08-10-105.

If the latest current recorded differs by more than 10 milliamperes from the previous recorded reading, retune transmitter in accordance with tuning instructions given under 100-Hour Inspection of the radio operator's position.

Turn low frequency SCR-274-N receiver volume control fully clockwise and leave for further tests of other equipment.



**Col RADIO COMPASS SET SCR-269-G.**

30

**Note**

Airplane should be located at least 200 feet from any large electrically conductive objects.

Make operating test on "ANT," observing:

Operation of control position light.

Action of tuning meter.

Action of lamp control and operation of all dial lights.

Presence of spare lamps.

Action of audio control.

Signal strength of a known station, interphone jack box volume control fully on.

Accuracy of frequency dial calibration.

Make operating test on "LOOP," observing:

Presence of signal.

Action of loop-drive control.

Make operating test on "COMP," observing signal strength and directional indication of the compass indicator pointer when a known station is tuned in on each frequency band.

Return switch to "ANT" position, tune in signal and leave volume control fully clockwise for further tests on other equipment.

**MARKER BEACON RECEIVER.**—Test operation of indicator light when test oscillator, set on 3000 cycles modulation, is brought into proximity with marker beacon antenna.

**Note**

Radio compass must be operating to furnish power for marker beacon receiver.

**RADIO OPERATOR'S POSITION.  
LIAISON RADIO SET SCR-287.**

Test receiver operation on "MVC" with a minimum of volume control on all bands, observing:

Operation of dial lights control.

Presence of audible beat note with "CW" oscillator switch on and variation of pitch when beat frequency adjustment is changed.

Action of crystal filter with the "CW" oscillator on.

Action of "AVC."

Align antenna for maximum signal input on approximately 500 kilocycles.

Test for intermittent contacts and receiver opera-

**Col** tion, while subjecting associated cordage and  
30 plugs to jarring.

Leave receiver turned on, signal tuned in and volume control fully clockwise for further tests on other equipment.

Test transmitter operation. Connect to external power source or start auxiliary power plant before making extensive tests on transmitter, if engine or engines are not running; otherwise, tests should be of extremely short duration. Place 24-volt/28-volt switch, in the tube compartment, in the appropriate position depending upon the voltage of the power source.

Observe all meters for abnormal readings with emission switch on "CW" and on "VOICE."

Place 24-volt/28-volt switch in the tube compartment in "28V" position for flight operation.

Lock tuning control locks.

**CHECK OPERATION OF SCR-595-A OR SCR-695-A.**

Make an aural test (with headset plugged into the phone jack of the control box) to determine the presence of undesired self-oscillation.

Locate properly adjusted test transmitter near the antenna and make an aural check with the headset plugged into the phone jack of the control box. The characteristic signal produced by the test transmitter and the radio set should be heard clearly. Care must be taken to insure that the test transmitter signal is being heard and not some unwanted oscillations from other sources.

Make an aural test of the operation of the "EMERGENCY" switch.

Before inserting the destroyer plug into the receiver, check for presence of unwanted voltage at the destroyer plug terminal.

Subject the inertia switch to light jarring and check for proper centering of reset plunger and indication of warning lights before inserting the destroyer plug.

**CHECK OPERATION OF ANTENNA REEL CONTROL BOX.**

Throw the reel control box switch to the "OUT" position and check operation of reel. Wire should reel out until the weight touches the ground.

Throw the reel control box switch to the "IN" position and reel the wire in.

Reset indicator to "000" if necessary.

**CHECK COMMAND SET SCR-274-N.**

(Equipment Rack Test.)

Col  
30

**Note**

The following inspection is to be performed while actually listening over a headset where applicable to the equipment under test.

Check command receiver and transmitter tubes to determine if they are properly seated in their sockets. (Power "OFF.")

Test the adjustment of the command receiver antenna alignment condenser on the high-frequency end of the frequency band while listening to a relatively weak signal.

Test for intermittent contacts (receiver operative) while subjecting receiver, antenna switching relay, dynamotor, and associated plugs and cordage to jarring.

**Note**

The antenna current meter is not calibrated in amperes. For the same current, each meter will deflect differently. Furthermore, the actual current depends upon individual antenna installations. Since there are two variable factors, the meter reading is only a rough indication of power fed into the antenna. However, the readings will not differ from day to day, for the same operating conditions, if the transmitters are functioning normally. The tests which follow should be made with regard to possible interference with radio communications in the vicinity of the air base.

Switch to "CW." Work key several times, noting deflection of antenna current meter when key is down and while listening for side tone. Dynamotor should run continuously.

Switch to "TONE." Work key several times, noting deflection of antenna current meter when key is down and listening for side tone. Dynamotor should run continuously.

Switch to "VOICE." Dynamotor should not run. Close "PRESS-TO-TALK" switch. Dynamotor should start. Note deflection of antenna current meter. Make a sustained "Ah-h-h-h" sound in the throat microphone. Antenna current meter reading should increase momentarily about 10 to 15 percent, and side tone should be heard.

Switch to "TONE." Lock key down by turning it clockwise. Subject modulator to jarring, listening in headset for evidence of loose elements or connections. Then subject transmitter to jarring, watching antenna current indicator for evidence of loose elements or connections.

Col If necessary, set transmitter to frequencies anticipated in flight.  
30

Listen to sound of each dynamotor for evidence of erratic operation.

Make over-all check by contacting tower or another airplane.

NAVIGATOR'S POSITION.  
RADIO COMPASS SET SCR-269-G.

**Note**

Airplane should be located at least 200 feet from any large electrically conductive objects.

Make operating test on "ANT," observing:

Operation of control position light.

Action of tuning meter.

Action of lamp control and operation of all dial lights.

Presence of spare lamps.

Action of audio control.

Signal strength of a known station, interphone jack box volume control fully on.

Accuracy of frequency dial calibration.

Make operating test on "COMP," observing signal strength and directional indication of the bearing indicator pointer when a known station is tuned in on each band.

Check receiver for intermittent contacts (receiver operative) while subjecting receiver, connecting plugs, and cordage to jarring.

Check operation with "CW-VOICE" switch in each position.

LOOP DEHYDRATOR UNIT.—If all the crystals have a dark blue color their condition is satisfactory. If one-half of the crystals are from light blue to pink in color, they must be reactivated, as their ability to absorb moisture is impaired. Service crystals as directed in paragraph 7. f., Section IV.

INTERPHONE.—Check operation of interphone jack boxes at all stations.

Test for presence of command receiver output on "COMMAND" position.

Check operation of volume control.

Test for presence of voice on "INTER" position.

Test for presence of voice on "CALL" position.

Test for presence of compass receiver output on "COMP" position.

Test for presence of liaison receiver output on "LIAISON" position.



Col Test for presence of intermittent contacts when  
30 interphone jack box and associated plugs and cordage are subjected to jarring.

### TURN OFF ALL EQUIPMENT

#### Anti-Icer Equipment

Operate the anti-icer system daily to prevent corrosion of the pumps and the subsequent clogging of the system. If this is not possible, the tank should be drained and an approved cleaning solvent pumped through the system.

#### Vacuum Pumps

Inspect vacuum pumps for security of mounting and for proper safety wiring. Inspect lines for tightness of joints, security of anchorage and general condition.

#### Fuselage

Inspect for general condition of the metal covering: tears, dents, evidence of leaks, broken structural members as evidenced by distortion of covering, and abrasions to paint or protective coating.

Abrasions should be retouched immediately to prevent corrosion.

#### Surfaces

Examine the metal covering of the wings for failure or local damage and for misaligned or faulty ribs, which may be indicated by distortion of the covering.

Inspect fillets and fairing for security of attachment and for cracks, dents, and bends.

Inspect for proper operation and security of inspection door attachments.

Inspect the horizontal and vertical stabilizers for general condition of the metal covering and of the ribs, as indicated by distortion, of the covering.

Inspect all movable surfaces for general condition, holes or other visible damage.

Inspect oil, fuel, and battery vents and overflow lines for security of anchorage, clogging, breaks, kinks and extension below cowlings or wings.

#### Cockpits and Cabins

Inspect for loose objects likely to obstruct movement of controls.

### WARNING

Do not load miscellaneous cargo in the airplane without the approval of the flight engineer.

Inspect for cleanliness, condition and functioning of mechanisms on windows, hatches, turrets,

Col emergency exits, cabin doors, etc., including  
30 proper operation of latches and locking devices.

### CAUTION

Use only soap and water, kerosene or naphtha to clean surfaces of transparent plastic panels. *Do not use acetone, benzene, lacquer, thinners, or abrasive cleaners. Use clean cloths.*

#### Night Flying Equipment

Inspect operation and condition of cockpit blackout curtains, cockpit lights, cabin lights, instrument lighting system, baggage compartment lights, lamp rheostat, landing lights, running lights, navigation and passing lights, and formation signal lights.

Check each landing light located in the leading edge of each of the outer wing panels, for operation. Any adjustment of the light may be made through the appropriate handhole on the top of each wing. Loosen the two clamps holding the light and slide the light assembly to the desired position before tightening down clamps.

#### Heating and Ventilating System

Inspect entire heating and ventilating system for leaks and general condition of units, lines, and fittings.

#### Hand Fire Extinguishers

Make sure that the fire extinguishers are fully charged. Replace any leaking extinguisher.

Check to see that seals are unbroken.

Check to see that dated inspection tags are attached.

Check for obstruction in the nozzle hole and for general condition of the extinguisher.

Check for security of attachment and condition of the bracket. See that the extinguisher can be easily removed.

#### Engine CO<sub>2</sub> Fire Extinguisher

(If Installed)

Note general condition, proper mounting, or attachment of distributing lines and connections.

#### Life Rafts

Check CO<sub>2</sub> cylinders or pneumatic life rafts to see that safety discs have not been ruptured. The CO<sub>2</sub> release cable must be disconnected from the life raft door latch before pulling the release handle.

Replace cylinder if necessary.

## PERIODIC INSPECTIONS

(Regular preflight and daily inspections will be performed in addition to the periodic inspections specified below.)

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11

### BOMBING EQUIPMENT

#### CAUTION

Bomb racks and control system parts should not be greased or oiled. The racks should be cleaned when necessary with kerosene, Federal Specification No. VV-K-211.

#### 25-Hour Inspection

Make detailed inspection of the structure, installation fittings, releasing and arming mechanisms, and electrical circuits of the bomb racks. Check for evidence of wear or failures.

Grease bomb door operating units, bomb release slide and bomb control levers, as shown in the Lubrication Chart (figure 43).

Inspect all connecting members, mechanical and electrical, between bomb rack control units and rack assemblies. Check control positions for proper relation throughout the system.

Thoroughly clean the entire control system. Determine correct operation with respect to both functioning and proper sequence of operation.

(See Section IV, paragraph 7. b.)

Col  
12

### GUNNERY EQUIPMENT

#### Lubrication

While lubrication is a necessary part of the maintenance of the chin, upper and lower turrets, it is equally important to avoid any excess of oil and grease.

#### CHIN TURRET.

The grease used in the turret is Specification No. AN-G-3. It is necessary to keep the grease at a definite level in the speed reducers, azimuth gear housing and elevation gear housings.

At the time of complete disassembly, the parts should be thoroughly washed, and should be lubricated with new grease when reassembled. The capacities of the assemblies are as follows: Azimuth gear housing, two pounds; elevation gear housing, .9 pounds; speed reducers, .5 pounds each.

To check the grease level of the azimuth gear assembly, unscrew the Allen head cap screw on the side of the housing. The grease must be at this level. If it is below, add grease. Remove the

Col plug on the top of the azimuth gear housing to  
12 add grease.

To check the grease in the speed reducer, back out the Allen head screw in the center of the side inspection plate. If the grease is not up to this height, remove the top inspection plate and add grease.

To check the grease in the elevation gear housing, remove the plug on the side of the gear housing. If the grease is not up to this level, add grease through the plug hole on top of the gear housing.

#### UPPER TURRET.

Lubricate all points of friction with a few drops of oil, AAF Specification AXS-777. Do not over-oil.

Using a hypodermic needle, put one drop of AAF Specification AXS-777 in each accessible bearing of the fire cut-off and limit stop unit.

Low temperature lubricating grease, Specification No. AN-G-3 should be used, when required, in the various gear boxes. Use only enough grease to provide proper lubrication.

Keep the sight mounting pin lubricated with aluminum soap grease, Specification AN-G-4.

#### LOWER TURRET.

Lubricate all points of friction with a few drops of oil, AAF Specification AXS-777. Do not over-oil.

The elevation hand crank housing and azimuth gear housing on the outside of the turret, and the self-aligning bearing at the top of the supporting structure were packed with grease when assembled at the factory and should require no regular attention.

The exposed azimuth gears and chain drive on the inside of the turret should receive a light coating of low temperature lubricating grease, Specification No. AN-G-3 when required. Do not leave excess grease.

All the gear cases inside the turret have removable screw plugs. These plugs will be removed at regular intervals and the oil level in the cases inspected. Fill if necessary with AN-G-3.

The hand control unit should be oiled occasionally by removing the two covers and putting a few drops of AAF Specification No. AVS-777 on the



Col bosses through which the plungers pass. The cen-  
12 tralizing springs should also be oiled with the same oil to avoid binding.

A placard on the left of the right hand ammunition box at the waist gun notes the date on which the lubrication has been made.

### General

Replace rubber extrusion around top of gunner's turret at first sign of deterioration. When installing rubber extrusion, adjust turnbuckles in operating mechanism so that turret and opening in fuselage are concentric.

All guns are properly boresighted before leaving the factory. This alignment should be checked after every military mission. The complete boresighting procedure must be fulfilled, in accordance with instructions given in Section IV, paragraph 7, *m.* (9), in any of the following conditions: whenever a gun is replaced or a turret is damaged; when replacing any turret drive parts; at turret replacement or adjustment; and upon completion of each fourth military mission, or when each gun has been fired a maximum of 4000 rounds.

### INSPECT CHIN TURRET:

Check operation and freedom of movement of the turret and gun sight.

Make a complete inspection of the gun mounts and their structure and working parts.

Inspect the related accessories for security of attachment and proper operation.

Inspect switches, relays, and solenoids for security of connections, correct operation, and general condition.

### 50-Hour Inspection

#### CHIN TURRET.

#### GUN SIGHT.

Check mounting bolts for security.

Check the elevation and azimuth sight gears for backlash and binding.

Check the flexible drive shafts and housings for fraying and signs of rusting.

Check for parallelism between the sight and guns.

#### CONTROL UNIT.

Remove the cover and inspect the wiring and insulation for chafing, loose connections, and signs of overheating.

Check the controller neutral in elevation and azimuth.

Check the operation of azimuth and elevation brake selector switches.

Col Check the potentiometer for signs of overheat-  
12 ing, and make sure the moving arm of each split potentiometer comes to rest over the split in the potentiometer at exactly the center of the spring-return neutral position.

Check the motor drive brushes for wear. If they are worn down to 1/16 of the brush holder, they should be replaced.

Inspect the commutator to see if cleaning is necessary.

Blow out end shield and armature to remove brush dust.

Inspect the internal wires for chafing, loose connections, and signs of overheating.

Check the grease level in the azimuth speed reducer, azimuth gear housing, elevation speed reducer, and elevation gear housing.

### JUNCTION BOX.

Remove the cover and inspect wiring and insulation for chafing, loose connections, and signs of overheating.

Check the operation of the azimuth limit switches underneath the junction box on the spider assembly.

### RESISTOR BOX.

Remove the cover plate and inspect the wiring and insulation for chafing, loose connections, and signs of overheating.

Check the operation and contacts of the high speed relay, azimuth electric dynamic brake, and power solenoid.

### LOWER RELAY BOX.

Remove the cover plate and inspect the wiring and insulation for chafing, loose connections, and signs of overheating.

Check the operation and contacts of the firing relay and the elevation dynamic brake.

Check the operation of the elevation limit switches.

### AMPLIDYNE MOTOR GENERATORS.

Check the brushes for wear. If they are worn to 1/16 inch of the brush holder, they should be replaced.

Inspect the commutator and determine if cleaning is necessary.

Inspect the internal wires for chafing, loose connectors, and signs of overheating.

GUN CRADLES.—Make a complete inspection. Inspect solenoids and other related parts for security of attachment and operation.

**Col HYDRAULIC GUN CHARGERS.**

- 12 Check for security of the attachment of the gun charger and the gun.

Check the hydraulic fittings for looseness and leakages.

Check the hydraulic hoses for fraying and signs of cracks.

Check the rotating hydraulic swivel joint located in the center of the turret for proper functioning.

Operate gun chargers and bleed air from hydraulic system.

**GUN STOPS.**—Check the degrees of clearance between the electrical dynamic brake stops and the manual stops in both azimuth and elevation. The electrical brakes should act a few degrees before the mechanical stops to allow for the over-travel of the turret after the electric brakes have been applied.

**WIRING AND CONDUIT.**

Inspect all wires for proper anchorage of conduit, wires, and bonding.

Check the condition of connections, insulations and terminals.

Clean the contacts of the main power relay.

Clean the contacts of the firing relay.

Clean the contacts of the azimuth and elevation dynamic brake relay.

Inspect the seat, including supports and struts, for security of attachment and condition, function of latches, and the condition of the cushions for breaks or sharp edges which would foul clothing.

**Col COMMUNICATIONS EQUIPMENT**  
**15**

**25-Hour Inspection**

This inspection shall be a daily inspection under supervision. The objective being to establish a uniform standard of inspection and maintenance as well as to provide a system that will be conducive to systematic training of maintenance personnel.

**100-Hour Inspection**

**GENERAL.**—Check Form 1A for any entries pertaining to communications equipment. Correct any defect noted not previously corrected and indicate, by appropriate entries, corrective action taken. Check for correctness of applicable Radio Facility Charts and other required Technical Orders of the 08-15 series and for presence of Technical Order Instruction Books for installed communications equipment.

**ANTENNAS.**—Make visual inspection of antenna.

- Col** Check of shock links and springs for tension and  
**15** deterioration.

Clean and check for nicks all exterior, fixed wire antennas.

If a reddish brown powder appears around the splices and ties, replace the antenna. Replace the trailing antenna wire only if examination shows it to be defective after reeling wire all the way out. Trailing antenna should be reeled in through a lightly oiled rag held in hand. Oil the pressure ball in top end of fairlead. See Technical Order No. 08-10-72 for further lubrication instructions. Check flared end of fairlead for notches caused by the antenna wire. Turn fairlead if necessary.

Clean insulators and inspect for cracks or chips.

Check marker beacon lead-in nut for tightness.

Check of marker beacon transmission line for continuity to ground (with antenna plug installed in receiver, should be a fraction of an ohm).

Check of marker beacon antenna for leakage to ground (antenna plug removed from receiver). The reading will vary with humidity conditions, but normally should be very high and on the order of megohms.

Check of marker beacon antenna for length (75 1/2 inches  $\pm$  1/8 inch overall from insulator eye to insulator eye). The lead-in is tapped off center (40 inches  $\pm$  1/8 inch from lead-in tap to one insulator eye).

Check loop antenna housing and mounting for cracks, tightness, water seal, and indication of excessive moisture in the dehydrator unit. Inspect the dehydrator crystals. Reactivate if necessary.

**PILOTS' POSITION.**

**COMMAND RECEIVER AND TRANSMITTER CONTROL BOXES.** Check for:

Proper action of switches.

Clean contacts on keys, switches, and jacks.

Tightness of control knobs, and handles.

Broken or corroded connections.

Loose or dirty plug socket contacts.

**INTERPHONE JACK BOXES AND FILTER SWITCH BOXES.**—Check for:

Proper action of switches.

Dirty or loose switch, jack, and plug contacts.

Broken or corroded connections.

Make operational check on all positions.

**CONTROL BOX BC-602-A.**

Loosen plug-locking ring on back of control box and remove plug PL-169 or PL-Q169, as the case may be.



**Col** Blow out dust with dry compressed air.

- 15 Inspect contacts of "T-R-REM" switch for loose, bent, or intermittent contacts.

If necessary, clean all switch contacts in control box with carbon tetrachloride or P-S-661 solvent.

Check operation of "T-R-REM" switch locking lever, located just above the switch. When the locking lever is positioned away from "T-R-REM" switch, switch should remain in any position in which it is placed. With locking lever positioned towards switch, the "REM" position is blocked, and the switch is spring-loaded so that, unless it is held in the "T" position, it returns to "R" position.

Check cams of each channel selector switch for a thin film of lubricant. If necessary use AAF Specification 3600 oil.

Examine wiring.

Check dimmer mask lever for freedom of action.

Replace side plate.

Replace plug and hand tighten locking ring.

With "T-R-REM" switch in "T" position press successive channel buttons, checking operation of signal lamps. Lamp adjacent to button depressed should glow. Throw "T-R-REM" switch to "R" position. Lamp adjacent to "T-R-REM" switch should glow, regardless of which channel is selected.

Press "OFF" button.

**RADIO COMPASS CONTROL BOX.**—Check for:

Cleanliness of chassis.

Dirty or loose plugs.

Broken or corroded connections.

Deterioration of parts.

#### Note

When removing control box, the plug-release screw (at lower left corner near the tuning crank) must not be loosened until the captive mounting screws have been fully disengaged. To install, tighten the plug-release screw first.

Make operation check as directed under 100-Hour Inspection at navigator's station.

**RADIO OPERATOR'S POSITION.**  
**LIAISON RADIO SET.**

Make receiver operating test on all bands with "CW" oscillator "ON." This test can be made by observing noise level with volume control at maximum.

**Col** Check dial lamps control and operation of the  
15 dial lamps.

Test and replace all defective tubes. Reinstall serviceable tubes in identical sockets from which they were removed.

Inspect receiver dynamotor by removing the five spade terminals from the dynamotor terminal strip; loosen the four captive screws which hold the dynamotor unit to the chassis. Remove end bells and inspect for:

Presence of carbon, dust, and dirt.

Short, chipped, cracked, or sticking brushes. Examine brushes to see that they have "worn in" properly and are free from hard spots on the contact surfaces. If commutator or brushes show signs of excessive wear, replace the dynamotor.

#### LIAISON TRANSMITTER.

Clean accumulated dust and dirt from all tuning units. Remove side and end panels from transmitter and clean it thoroughly using an air hose or bellows, paying particular attention to the variable inductance coil in the antenna compartment. Clean the winding thoroughly with a clean cloth while running the tap through from stop to stop. Tap should be against stops at minimum and maximum dial readings.

Check safetying, rigid fastening of mounting brackets and supports, and nuts and machine screws for lock washers and tightness.

Check cords for broken shielding and make sure all grounding and bonding is in place.

Inspect plugs for proper fit, and plug sockets for compressed pin springs. Compressed pin springs, which have taken a permanent set, can be restored by a light hammer blow on the end of the pin.

Make certain all fuses and clips are tight and free of corrosion, and that spare clips are filled.

Check the calibration accuracy (especially if the M.O. tube has been changed) observing the following steps:

Place transmitter tuning unit TU-10- ( ) in transmitter.

Set transmitter tuning controls to positions appropriate for "CW" operation on 12,500 kcs.

#### CAUTION

M.O. control "B" must be set in accordance with calibration chart approaching the final setting from a lower dial reading to a higher one.

Place filament voltage switch in tube compartment in appropriate position and replace the tube shield. To prevent excessive battery dis-

Col charge, the liaison transmitter should not be operated (except in emergency) on the airplane's batteries alone. Use the auxiliary power unit, a suitable battery cart or portable generator. When using an external source of power, do not exceed an input of 28.5 volts.

Tune transmitter into its antenna or a suitable phantom antenna for normal "CW" operation and lock the key down.

Place frequency meter near the transmitter and turn it on.

Allow both frequency meter and transmitter to warm for at least 10 minutes. In any event make certain the "beat note" between the master oscillator and the crystal oscillator in the frequency meter no longer "drifts."

Release the transmitter key and set the frequency meter on 12,500 kcs, according to its operating instructions and calibration chart.

Open the calibration reset port, located on the front panel, between the test key and "TONE-CW-VOICE" switch, insert a screw driver, and rotate the calibration reset capacitor until the transmitter frequency coincides with that of the frequency meter. The two signals should coincide when the PLATE CURRENT ammeter reading is at minimum value (dip).

Close the calibration reset port. The transmitter calibration is now reset for any tuning unit of the same order number and serial number as the transmitter and the accuracy of calibration will be within 0.05 percent plus the accuracy of the standard.

The calibration must be checked in this manner each time the M.O. tube is changed.

Before use it will be necessary to tune transmitter in accordance with operating instructions.

Place filament voltage switch in tube compartment in appropriate position.

Tune the transmitter observing all meters for abnormal readings with emission switch on "CW" and "VOICE."

Observe side tone level and adjust if necessary.

Observe that spare fuse holders are filled with good fuses.

The filament voltage should be 10 volts; if not, perform the following operations:

Place the filament voltage switch, in the tube compartment, in the 28.5 volt position. (Operating one or more engines, the auxiliary power

Col plant, or an external power unit will furnish appropriate voltage. Check for necessary 28.5 volts input if an external power source is used.)

Set the transmitter signal selector switch on "CW" and the filament voltmeter switch on "CW FIL." Remove high voltage plug from the dynamotor (dynamotor must be running to get proper line-drop). Uncouple the antenna by throwing antenna switch open.

Remove all links from filament resistor board in the tube compartment.

Turn on transmitter and test until the two studs are found between "28V" and "CW FILAMENT" that when connected will cause the voltmeter to read 10 volts. Turn transmitter off and connect these terminals.

Set transmitter signal selector switch on "VOICE" and the filament voltmeter switch on "MOD. FILAMENT" and turn on transmitter.

Repeat above operation for the "28V" and "MOD. FILAMENT" row of studs.

Turn transmitter on. Set filament voltmeter switch on "CW-FIL." The "CW" filament voltage will now be less than 10 volts.

In the same manner, connect between the adjacent studs of the "COMP" and "CW FILAMENT" rows until the filament voltmeter again reads slightly over 10 volts. Turn off transmitter and connect this link at proper place.

Cut off the charging generator (engines, auxiliary power plant or external power unit) so that a 24 volt supply is effective (preferably a battery cart). Throw the filament voltage switch in the 24 volt position and in a similar manner proceed to select the proper studs on the "24V" and "CW FILAMENT" rows and the "24V" and "MOD. FILAMENT" rows so that the filament voltmeter will indicate the 10 volts in either position.

Turn off transmitter, replace dynamotor high voltage plug, and couple antenna to transmitter.

Retune transmitter.

Remove the dynamotor end bells and inspect for:

Presence of carbon dust and dirt.

Free movement of armature.

Presence of spare fuse and fuse links.

Short, chipped, cracked, or sticking brushes. Examine brushes to see that they have "worn in" properly and are free from hard spots on the contact surfaces. If commutator or brushes show signs of excessive wear, replace dynamotor.



**Col** COMMAND RECEIVERS OF SCR-274-N SET.

- 15 Make an aural check on the operation of each receiver by listening to signals on "CW" at maximum gain while tuning through the entire band. All receivers except the one being tested should be turned off.

Test all tubes on tube checker. Replace any defective tubes; reinstall good tubes in identical sockets from which they were removed.

Check for correspondence of receiver dials with the reading of the remote tuning dials and correct them if necessary.

Check antenna alignment:

Set the power switch controlling the first receiver to "CW."

Check to see that the "A TEL-B-TEL" switch of the same control box section is set at "A-TEL" and plug a headset into the "A-TEL" jack or the interphone jack box.

Set the gain control knob to maximum gain position.

Tune the receiver to the highest frequency.

Align the antenna input circuit for maximum background noise using the "ALIGN INPUT" knob on the front of the receiver.

Switch the receiver off and perform a similar operation on each of the other receivers in turn.

Remove the end bells on receiver dynamotors and inspect for:

Presence of carbon dust and dirt.

Free movement of armature.

Short, chipped, cracked or sticking brushes, examine brushes to see that they have "worn in" properly and are free from hard spots on the contact surfaces.

If commutator or brushes show signs of excessive wear, replace the dynamotor.

Inspect to see that all safety wiring is in place.

**COMMAND TRANSMITTERS OF SCR-274-N SET.**

Check for presence of carrier modulation, indicated by antenna current meter.

Check the assigned operating frequency with the frequency meter.

If retuning is necessary, perform, with the transmitter power off, the following operations:

- Col** Set the "FREQUENCY" control dial to the desired transmitting frequency.

- 15 Set "ANT COUPLING" control to about 3 on scale.

Throw toggle switch on antenna relay unit BC-442-A to "LOCAL."

Set radio control box BC-451-A emission switch to "CW" and selector switch to No. 1 or No. 2 depending on which transmitter is being tuned.

Turn on "TRANS POWER" switch (neither microphone button nor the key should be closed) and allow a 15 second warm-up period.

Lock the key on top of the control box by rotating it clockwise.

Resonate the antenna circuit by adjusting the "ANT INDUCTANCE" for maximum antenna current. (Maximum series inductance is in circuit when the contact button behind the transparent window is in the extreme right-hand position.) This adjustment should be made with the "ANT COUPLING" at a lower setting than that which gives the highest antenna current.

Vary the "ANT COUPLING" until maximum "CW" antenna current is indicated on the R-F ammeter of the antenna relay unit, with the switch in the "LOCAL" position.

Retrim the "ANT INDUCTANCE" tuning, for maximum "CW" antenna current. Observe antenna current on "VOICE" and "TONE." On "VOICE" the reading will be less than for "CW," and for "TONE" it will be between the values for "CW" and "VOICE."

The second transmitter may be tuned up following the same routine as for the first. It is then good practice to return to the first transmitter and retrim the "ANT INDUCTANCE" control on "CW."

Lock all controls and switch the antenna relay unit to "REMOTE."

Each transmitter has a special frequency checking circuit which includes a plug-in crystal resonator (it does not control the frequency).

The frequencies of the crystals supplied with the different transmitters are as follows:

<i>Radio Transmitter</i>	<i>Crystal Frequency</i>
BC-457-A (4-5.3 MC)	4.6 MC
BC-458-A (5-7.3 MC)	6.2 MC
BC-459-A (7-9.1 MC)	8.0 MC

**Note**

Always check the frequency calibration after any tube is replaced in the transmitter.

Col 15 The frequencies may be checked by performing the following steps:

Open hinged cover (at top rear of transmitter) to such an angle that the reflection of the entire resonance indicator screen of Tube VT-138 may be seen.

Tune the transmitter to the lowest frequency which will cause the shadow on the VT-138 tube to open up to a sharp maximum in the width of the shadow. The indicated dial frequency should now correspond with that of the crystal. If it does not, set the dial on the nominal frequency of the crystal and trim the master oscillator capacitor to make it so. This trimmer may be adjusted with a small metal screw driver inserted through the hole in the top of the transmitter which is covered with a metal snap slide. (A clockwise rotation of this trimming control lowers the transmitter frequency.) The calibration engraved on the frequency dial of the transmitter will then be correct at all parts of the dial.

**Note**

When properly calibrated, the frequency emitted by a transmitter is within plus or minus three percent of the frequency indicated by the dial unless otherwise noted by a notice in yellow ink stamped on the transmitter dial, in which case the calibration accuracy cannot be depended upon closer than the figure in the notice.

If the transmitter is operating satisfactorily, the dynamotor of the modulator unit should rarely be touched, other than the major overhaul performed by an Air Force shop or a routine examination for impending mechanical failure. Remove the end bells and inspect for:

Presence of carbon dust and dirt.

Short, chipped, cracked, or sticking brushes.

Free movement of armature.

If commutator or brushes show signs of excessive wear, replace dynamotor.

SCR-522-A VHF COMMAND SET.

**Note**

Radio set SCR-522-A is designed for automatic operation to a degree never before achieved. Adjustments of many of the various components are interdependent and extremely critical. These adjustments are made at the factory prior to shipment, or, in case of major repairs, at the various Area Air Service Commands which have facilities for making such adjustments. Only the adjustments

Col 15

specifically listed under the inspection procedures are to be executed. Immediate corrections of the majority of failures encountered in the field can be accomplished by simple repair. Frequently simple failures result in unauthorized tampering with critical adjustments, thereby rendering the entire unit inoperative for a long period of time. Due to complexity of some of these adjustments only authorized personnel having proper facilities should attempt them. The procedures contained herein will be strictly adhered to in the execution of inspections.

Check security of mountings of component parts. Inspect ground straps for positive electrical connection. Hand tighten all plug-locking rings and plug-end rings.

Inspect all cables for signs of chafing or wear due to vibration. Check for proper security and bonding to airplane.

Inspect antenna mast for security of mountings, positive ground connection to skin of airplane, and for cracking at base.

Remove covers of all junction and jack boxes. Inspect wiring connections to plug sockets. Check plug sockets for corrosion or loose pins.

Inspect dynamotor.

Loosen plug locking ring on plug PL-P172 or PL-Q172, and remove.

Remove dynamotor unit cover.

Remove brush or dust covers on dynamotor, if any are used.

With dry compressed air, gently blow carbon and copper dust from all four commutators, and from armature near commutators.

Inspect brush holder mounting slots for cracks or fractures. (Brush holder is used on PE-94-A and PE-98-A.)

Inspect for restricted or sticking brushes, at same time making certain that brush springs are in proper place and exerting proper brush pressure.

If commutators or brushes show signs of excessive wear, exchange the unit.

Replace dynamotor cover, making absolutely certain that cover is installed so that ventilated portions of the ends of cover are adjacent to dynamotor proper and not adjacent to associated filter sections.



Col  
15**Note**

Correct installation of cover was not designated on early run dynamotors, so extreme care must be taken to reinstall correctly. Later runs have red arrows or dots that must coincide if cover is properly installed.

Replace plug and tighten locking ring.

Inspect rack, transmitter, and receiver as follows:

Push "OFF" button on radio control box BC-602-A.

Unfasten Dzus fasteners on receiver and transmitter covers. Open them so that rack, receiver, and transmitter control are in view.

Turn unit on by pushing any channel button. With thumb or finger press armature of relay (figure 463, detail 22) towards field coil until contacts close and ratchet or shifter motor runs continuously.

Holding this relay closed *count* the number of revolutions the motor makes per minute, as it shifts continuously from one channel to another.

Release armature. The number of revolutions per minute of the motor should be approximately as indicated below for various temperatures:

<i>Temperature in Centigrade</i>	<i>Minimum Revolutions Per Minute</i>
+60	22
+40	24
+20	24
0	22
-20	20
-40	18

Press channel release button (figure 446, detail 8) once and release. This will release all slides.

Push "OFF" button on control box.

Loosen plug locking rings, and remove plugs from receptacles (figure 446, details 3, 19, and 20).

Unfasten two large Dzus fasteners located on each side of case CS-80-A.

By use of handles in each end of rack, lift the rack, receiver, and transmitter assembly out of the case.

Making certain rack slides are disengaged, disassemble receiver and transmitter from rack by

Col removing four red mounting screws in each unit  
15 (figure 463, details 4 and 6).

Inspect rack, FT-244-A, as follows:

Remove six screws securing rack center cover (figure 463, detail 5) and remove center cover.

Blow dust and dirt out with dry compressed air. Avoid subjecting delicate parts to direct blasts.

Inspect mounting screws and electrical connections of antenna receptacle (figure 463, detail 19).

Inspect mounting screws and electrical connections on antenna relay. Clean and burnish or polish relay contact points. Do not use any kind of abrasive for burnishing. If a burnishing tool is not available, clean contact points with a flat tooth pick dipped in carbon tetrachloride, working tooth pick between points.

Inspect condition of pins of receptacles (figure 463, details 3 and 20).

Inspect relays (figure 463, details 7 and 22) by pressing armature lightly until it stops, then check contact points of relay, verifying good connection.

If necessary clean contact points as directed above.

Inspect cable wiring for wear where it goes through the center channel of the rack. At same time inspect cable where it passes under receptacle (figure 463, detail 3) and over shifter mechanism shield.

Clean and lubricate each of the four channels of the rack shifter mechanism, and ratchet motor.

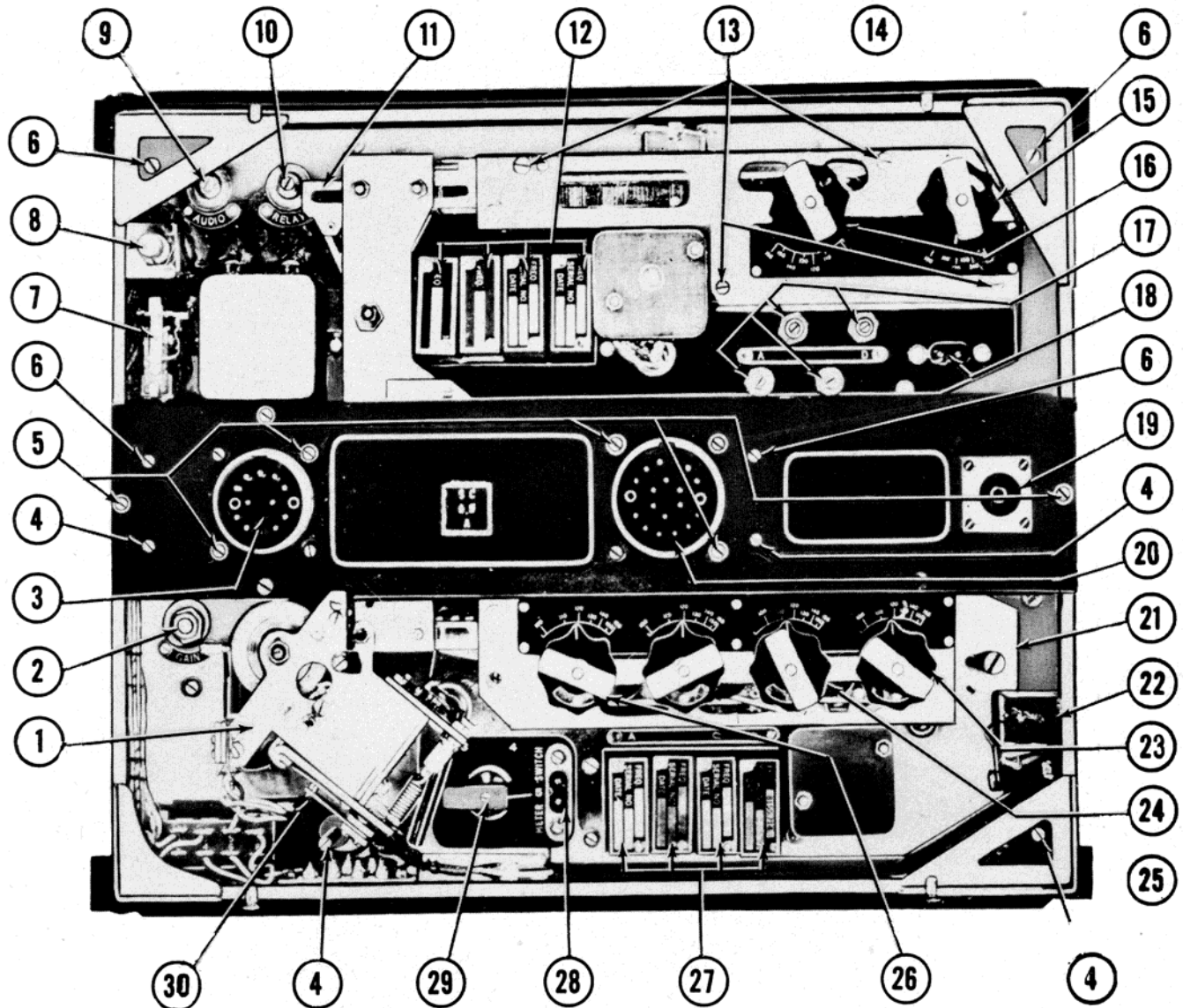
**Note**

If rack is stood in its end with motor down and operator makes inspection from bottom or back of rack, the cross arms are more accessible.

Using carbon tetrachloride or P-S-661 solvent, clean dirty grease from:

Receiver shifter actuating slides (figure 464, detail 7) and their respective tracks and spacers.

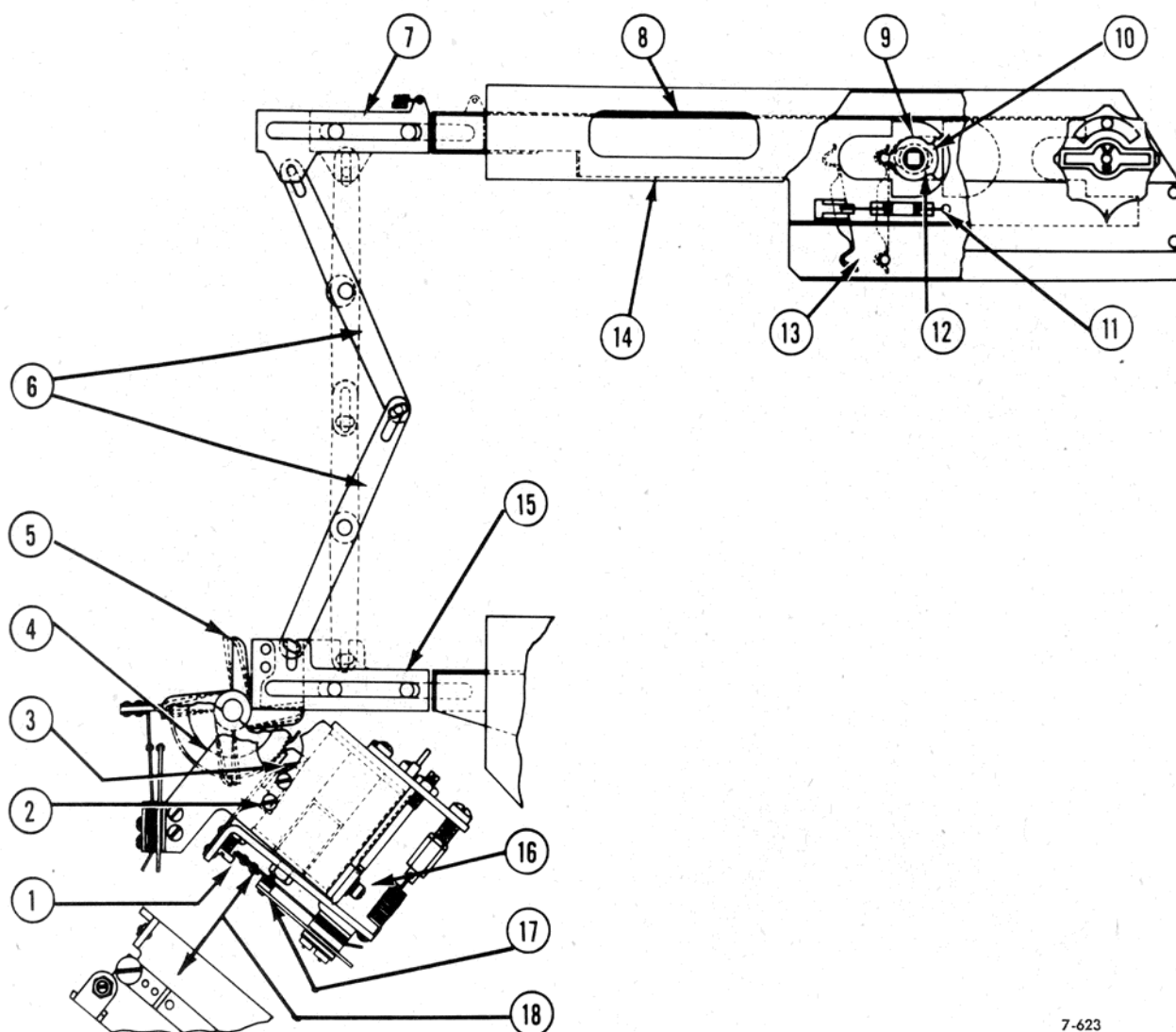
Transmitter shifter actuating slides (figure 464, detail 15) and their respective tracks and spacers and slide heads.



- |  |   |   |
|--|---|---|
| 1. Ratchet Motor                       | 13. Frequency Shifter Mounting Screws   | 22. Relay (Motor Control)                       |
| 2. Gain Control                        | 14. Receiver Tuning Control Lock Nuts   | 23. Power Amplifier Plate Tuning Control        |
| 3. Power Socket                        | 15. Receiver Tuning Control (RF)        | 24. 2nd Harmonic Amplifier Plate Tuning Control |
| 4. Transmitter Mounting Screws         | 16. Receiver Tuning Control (OSC)       | 25. 1st Harmonic Amplifier Plate Tuning Control |
| 5. Center Cover Screws                 | 17. Oscillator Plate Coil Tuning Screws | 26. Oscillator Plate Tuning Control             |
| 6. Receiver Mounting Screws            | 18. Receiver Test Milliammeter Socket   | 27. Transmitter Crystals                        |
| 7. Relay (Locking)                     | 19. Antenna Receptacle                  | 28. Transmitter (D-C) Meter Socket              |
| 8. Channel Release Button              | 20. Control Socket                      | 29. Meter Switch                                |
| 9. Audio Gain Control                  | 21. Antenna Coupling Control Lockscrew  | 30. Interrupter Contacts                        |
| 10. Squelch Relay Control              |   |   |
| 11. Frequency Shifter Actuating Slides |   |   |
| 12. Receiver Crystals                  |   |   |

Figure 463—Transmitter-Receiver Assembly, Covers Open, Top View





7-623

1. Interrupter Adjusting Screw
2. Pawl Stop Block
3. Pawl
4. Ratchet Wheel
5. Motor Arm
6. Cross Arms
7. Receiver Shifter Actuating Slide
8. Receiver Shifter Slide
9. Cam

10. Cam Shaft
11. Clip Spring
12. Cam Spacer
13. Positioning Clip
14. Receiver Frequency Shifter
15. Transmitter Shifter Actuating Slide
16. Armature Hinge
17. Interrupter Contacts
18. Armature

**Figure 464—Rack Mechanism and Ratchet Motor (SCR 522-A)**

*Col* Motor arms (figure 464, detail 5).

- 15 Each pair of cross arms (figure 447, detail 6) at each end and at pivoting point.  
Ratchet wheel of motor (figure 447, detail 4).

*Col* Pawl and pawl stop of motor (figure 464, details 2 and 3).

Hinge assembly on motor (figure 464, detail 16).  
Inspect the track in each receiver and transmit-

Col 15 ter actuating slide for undue wear or roughness.

Apply grease, Specification AN-G-3 to:

Heads of shifter slides (actuating).

Teeth of ratchet wheel.

Pin and slot bearing surfaces at each end of cross arms.

Apply oil, Specification 3600, to:

Ratchet wheel shaft.

Cross arm pivot bearings, its slots and large bushings for both transmitter and receiver shifter actuating slides.

Inspect motor interrupter contacts (figures 463, detail 30 and 464, detail 17) for build-up on the tungsten contact. Do not attempt to clean the motor interrupter contacts unless the build-up of silver on the tungsten contact is excessive. A small deposit of silver on the tungsten is harmful only if the relative lateral positioning of the contacts is disturbed. The cleaning operation, when necessary, should be confined to the removal of all silver which may be deposited on the tungsten. Do this by using an extremely thin, single-faced contact file or a magnet point file which has one side ground off, leaving the thickness approximately .010 to .015 inch. After filing, clean the tungsten contact by dressing with fine sandpaper. Do not clean silver contact. After filing is completed, set interrupter adjustment screw (figure 464, detail 1) so that interrupter contacts open approximately .006 inch with the armature in full energized position. Apply glyptol to threads of screw if adjusted.

Inspect receiver as follows:

Remove tubes, after marking in such a manner that each may be returned to its original socket, and test in a tube tester. Replace tubes in original sockets after testing and replacing any defective tubes. Make certain the tube retaining clips on the VT-203's and VT-202's hold the tubes firmly in their sockets.

#### Note

Vacuum Tubes VT-202 and VT-203 will exhibit white oxides if there is an air leak due to a crack in the tube base. Any of these tubes which show signs of oxidations, should be replaced immediately. Vacuum tubes VT-202, VT-203, and VT-118 are designed for VHF operation, and consequently do not have molded bases. Pins are secured directly to the glass envelope. This construction,

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though necessary, is mechanically weak. Extreme caution must be exercised in removing and installing these tubes. Remove tubes from sockets by pulling nearly straight up. Install tubes by pushing nearly straight down. A slight rocking motion may be used with extreme care. Inspect any sockets into which tubes fit unusually hard, as cracks may form later from prolonged strain on the pins.

Place receiver on bench with slides and tuning controls up.

#### Note

As the component parts of both the receiver and transmitter are being inspected as specifically directed in this manual, a visual inspection may be made of the electrical connections to that part. Loose joints, frayed leads, broken strands of wire, or nearly shorted connections are the chief sources of trouble encountered.

Rotate the two tuning controls (figure 463, details 15 and 16) making certain that each turns easily and does not bind.

Inspect security of four frequency shifter mounting screws (figure 463, detail 13).

Inspect mounting nuts on "AUDIO" control (figure 463, detail 9) and "RELAY" control (figure 463, detail 10). If loose, these must be tightened and sealed with glyptol.

Using a small screw driver, turn shaft of both controls. There should be a definite drag as shaft is rotated.

Inspect mounting screws of all plugs or receptacles.

Push each individual shifter slide in, with finger, until it seats firmly.

Release quickly. Slide will return to released position. Tuning controls should rotate to their respective settings as each slide is depressed, unless a cam or positioning clip or clip spring is defective.

Inspect four cam assemblies (figure 464, detail 9) on each tuning control for bent or worn parts.

Inspect four positioning clips and clip springs on each stack assembly (figure 464, detail 13).

Clean dirty bearing surfaces of shifter slides with carbon tetrachloride or P-S-661 solvent.

Apply grease, Specification AN-G-3, to any bearing surface cleaned. If cam or cam shaft assemblies



Col are cleaned it will be necessary to lubricate cams  
15 and spacer (figure 464, detail 12) generously with oil, AAF Specification 3600.

Place receiver on bench with tuning controls facing operator and with shifter near top.

Inspect security of mounting of R-F and oscillator assembly.

Inspect mounting nuts on crystal board.

By grasping, inspect the security of the various parts mounted on the chassis.

With receiver placed with bottom up, exposing small tubes and under-chassis wiring, accomplish following inspection:

Check security of three mounting screws on end of chassis holding R-F and oscillator assembly.

Check security of mounting screws and nuts of each component part that is accessible from bottom of chassis.

Investigate any evidence of wearing of cables in chassis.

Inspect transmitter.

Place transmitter on bench with tuning controls up. Remove power amplifier shield, located on end of chassis, by loosening four Dzus fasteners. Remove tubes, after marking in such a manner as to insure each tube being returned to its original socket, and test in tube tester.

#### Note

If a tube tester which accommodates vacuum tube VT-118 is not available, check as directed in paragraph (18) following.

Replace tubes in original sockets after testing and replacing all defective tubes.

Check security of parts and wiring in power amplifier section.

Replace power amplifier shield making certain that Mycalex strip rests securely between plate pins on vacuum tube VT-118, and is exerting a downward pressure.

Inspect security of four frequency shifter mounting screws.

Rotate each of four tuning controls, making certain that each turns easily.

Inspect mounting nut on "GAIN" control (figure 463, detail 2). If loose, tighten and seal with glyptol.

Rotate knob of meter switch (figure 463, detail 29) from position 1 to 6 and check for normal rotation and locking.

Col Push each individual shifter slide in, with  
15 finger, until it seats firmly.

Release quickly. Slide will return to released position. Tuning controls should rotate to their respective settings as each slide is depressed. If not, a cam or positioning clip or clip spring is defective.

Inspect four cam assemblies on each tuning control for bent or worn parts.

Inspect four positioning clips and clip springs on each stock assembly.

Clean dirty bearing surface of shifter slides with carbon tetrachloride or P-S-661 solvent.

Apply grease, Specification AN-G-3, to any bearing surfaces cleaned. If cam or cam shaft assemblies are cleaned it will be necessary to lubricate cams and spacers generously with AAF Specification 3600 oil.

Place transmitter on one side, then on other side and finally up on one end, and in each position inspect security of component parts accessible while it is in that position.

Reassemble receiver and transmitter with rack. Make certain before tightening the mounting screws of receiver or transmitter that their respective actuating slides are approximately 1/32 inch from slide assemblies when in released position.

Reassemble in case CS-80-A and connect plugs on rack.

If vacuum tubes VT-118 were not tested in the tube tester, proceed as follows:

Plug test set I-139-A into meter socket (figure 463, detail 28) and turn meter switch knob (figure 463, detail 29) to position No. 2.

Turn set on by pushing channel "A" button.

Allow a two minute warm up period.

Record reading of test set I-139-A.

Turn set "OFF" and remove from case.

Install a vacuum tube, VT-118, known to be in good condition, in the second harmonic amplifier socket. This is accessible from bottom of transmitter.

Replace in case, turn on "A" channel and after a two minute warm up, record reading of test set I-139-A.

If current recorded with known good tube in socket exceeds appreciably the original current, replace old tube.

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**Note**

Instances may be encountered where an old tube, or even a new tube, reads 20 or more milliamperes above an average reading. If this is encountered, try several tubes. Occasionally a tube is gassy and this causes excessive plate current readings. Gassy tubes are never to be used.

Turn meter switch knob to position No. 3 and record reading.

Turn set "OFF" and remove from case.

Install a vacuum tube VT-118, known to be in good condition, in the power amplifier socket. To reach this tube it will be necessary to remove power amplifier shield on end of transmitter.

Replace tube shield and install in case.

Proceed as directed for checking VT-118.

Reinstall case CS-80-A in airplane.

Accomplish complete tune up of transmitter and receiver.

**RECEIVER TUNING PROCEDURE.**—Plug transmitter crystal for frequency of channel to be tuned into the crystal socket of I-130-A (or I-96-A) signal generator. Plug test set I-139-A into signal generator "meter" socket and turn on the signal generator as follows:

Turn "M.O. CRYSTAL" to "CRYSTAL" position.

Set "OUTPUT STEPS" control to position No. 2, and turn "OUTPUT CONTROL" to maximum.

Adjust "CRYSTAL TUNING CONTROL" to the dip or minimum reading on test set, I-139 (meter), nearest the dial frequency of transmission. Set "MEGACYCLES" control to approximately same setting as reading on "CRYSTAL CONTROL" dial. Tune large dial for minimum reading of meter. Connect signal generator "RF OUTPUT" socket and receiver antenna socket SO-183 by means of Cable CD-477. If no signal generator is available, a buzzer can be used and the intensity regulated by moving it away from the antenna. Type of signal source is not important since the channels are crystal controlled and it is only necessary to tune for maximum output.

Install crystals (figure 463, detail 12) corresponding to assigned frequencies in crystal sockets of receivers.

To turn set on, press control box button for channel immediately preceding channel to be tuned

Col and allow receiver a two minute warm-up period.  
15 **TUNING CIRCUIT ADJUSTMENT (RECEIVER SECTION).**

Press channel release button (figure 463, detail 8).

Loosen locknuts in controls (figure 463, detail 14) so they exert a slight pressure on cams beneath.

Press control box button for channel to be tuned.

Loosen locknuts completely.

Turn audio squelch "RELAY" (figure 463, detail 10) and "AUDIO" gain (figure 463, detail 9) controls to extreme clockwise position.

Connect output meter (0-30 volt scale) to the jack box output terminals. If an output meter is not available, use a headset to check for maximum output.

Turn oscillator plate coil tuning screws (figure 463, detail 17), for channel being tuned, counterclockwise until from three to five threads extend above the sleeve.

Turn both tuning controls (figure 463, details 15 and 16) to approximately same setting as "CRYSTAL TUNING" dial on signal generator. Rock controls across this setting and locate on both a point of maximum meter reading on headset output.

If no signal is found, turn oscillator plate coil tuning screw (figure 463, detail 17) corresponding to the band being tuned out one turn at a time and repeat rocking procedure until signal is located and point of maximum signal is found.

If meter reads off scale, or headset output is too strong, reduce signal generator output by turning "OUTPUT CONTROL" counterclockwise.

Turn plate coil tuning screw clockwise until output drops abruptly. One or more peaks may be passed through as screw is turned, but correct point will be identified by its very sharp cut-off.

Turn plate coil tuning screw counterclockwise until output is again evident on meter or phones, then 1/2 to 3/4 turns counterclockwise beyond this point to insure stable crystal operation.

Retune both controls for maximum output.

Hold tuning controls in exact position to which they were adjusted and tighten locknuts to exert a slight pressure on cams.

Install transmitter crystal, for frequency of next channel to be adjusted, in signal generator and retune signal generator.



Col Press control box button for next channel to be  
15 tuned.

Loosen tuning control locknuts completely.

Proceed with tuning of this channel as directed above.

Tune remaining channels in same manner. After completing tuning of last channel, hold tuning controls in exact position to which they were adjusted and tighten locknuts to exert a slight pressure on cams.

Press channel release button (figure 463, detail 8) and tighten locknuts as tightly as possible with the fingers.

#### RELAY CONTROL ADJUSTMENT.

Turn the set on and listen with a headset plugged into the jack box. Select a channel over which no signal is being received.

Turn the "RELAY" control screw (figure 463, detail 10) in a clockwise direction (if no background noise is heard) until a strong background noise level is obtained.

Turn the "RELAY" control screw in a counterclockwise direction until the noise drops abruptly, then a fraction of a turn beyond, in order to avoid relay flutter point. This relay is a squelch control and turns the receiving section off when no signal is being received, and turns the receiver on when a signal is being received.

#### AUDIO CONTROL ADJUSTMENT.

If pilot's jack box installed in the plane has no volume control, turn "AUDIO" control screw (figure 463, detail 9) clockwise from full counterclockwise position until headset volume, as determined preferably by the pilot while listening to signal emission of another SCR-552 set, is normal. This setting is usually about 1/3 turn from full counterclockwise position.

If the pilot's jack box has a volume control, set "AUDIO" control screw at full clockwise position.

#### TRANSMITTER TUNING PROCEDURE.

Install crystals corresponding to the assigned channel frequencies in transmitter crystal sockets (figure 463, detail 27).

Plug I-139-A into meter socket on transmitter (figure 463, detail 28).

Turn set on by pressing control box button for channel immediately preceding lowest frequency channel to be tuned and allow a two-minute warm-up period.

Col Press channel release button (figure 463, detail 8)  
15 and loosen the four tuning control locknuts on the transmitter tuning controls slightly by turning counterclockwise. Tighten the locknuts until they exert only a moderate pressure on the cams beneath.

Press control box button for lowest frequency channel to be tuned.

Loosen tuning control locknuts until tuning control knob pointers can be rotated.

Place control box selector switch "T-R-REM" in the "T" position.

Place transmitter meter switch (figure 463, detail 29) in position "1."

#### TUNING CIRCUIT ADJUSTMENT—LOWEST FREQUENCY CHANNEL (TRANSMITTER SECTION).

Adjust oscillator plate tuning control (figure 463, detail 26) for maximum meter reading.

Place transmitter meter switch in position "2." Adjust first harmonic amplifier plate tuning control (figure 463, detail 25) for maximum meter reading.

Place transmitter meter switch in position "3." Adjust second harmonic amplifier plate tuning control (figure 463, detail 24) for maximum meter reading.

Adjust power amplifier plate tuning control (figure 463, detail 23) with meter switch still in position "3" for dip, or minimum reading.

#### Note

This adjustment should immediately follow the adjustment made on second harmonic amplifier to prevent possible damage to power amplifier tube elements. Repeat adjustment of second harmonic and power amplifier plate tuning controls several times in order to be certain of actual maximum and minimum readings, respectively. Final reading should be approximately 63 MA. If not obtained, antenna coupling requires adjustment.

#### ANTENNA COUPLING ADJUSTMENTS (TRANSMITTER SECTION).

#### Note

Antenna coupling adjustment is to be made only with transmitter operating on the lowest frequency channel. Extreme care is necessary when tightening antenna coupling lock screw after comple-

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tion of adjustment, as it must be tightened securely but not with excessive force, or damage to coil mounting parts will result. It will be found easier to make this adjustment with two screw drivers, one being used as a lever between the adjacent edge of the rack and the lock screw and the other being used to tighten the tension on the lock screw while the "lever" is holding it in place.

If final reading obtained above was *less* than 63MA, turn off transmitter, slightly loosen antenna coupling control lock screw (figure 463, detail 21) and move it toward the tuning controls. (If more than 63MA, move away from tuning controls.) Turn on transmitter, retune power amplifier plate tuning control for minimum reading. If 63MA is not obtained, repeat operation.

#### Note

It is preferable to turn off transmitter when making this adjustment. If tuned with transmitter power on, care should be taken not to permit the coupling coil to touch the plate coil; otherwise, high voltage supply will be grounded through coupling coil.

Tighten antenna coupling lock screw.

After completion of antenna coupling adjustment, record meter readings with meter switch on positions 1, 2 and 3 for reference in subsequent operations.

Hold tuning controls in exact position to which they were adjusted and tighten locknuts to exert a moderate pressure on cams.

Recheck meter reading. If different reading is attained than the recorded reading, the tuning controls were disturbed in tightening the locknuts and channel must be completely retuned.

#### TUNING CIRCUIT ADJUSTMENTS ON CHANNELS OTHER THAN LOWEST FREQUENCY (TRANSMITTER SECTION).

Press control box button for next channel.

Loosen locknuts slightly.

Repeat tuning procedure given for lowest frequency channel. Do not repeat antenna coupling adjustment.

Record meter readings of switch positions 1, 2, and 3 after completion of tuning this channel.

Repeat tuning operations for the remaining channels.

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#### Note

Meter readings for switch position No. 3 will probably be found progressively lower for successively higher frequency channels. Good results are obtained with a meter reading as low as 45 MA on highest frequency channel.

#### CHECKING TUNING ADJUSTMENTS (TRANSMITTER SECTION).

Hold tuning controls in exact position to which they were adjusted and tighten locknuts until they exert a slight pressure on cams.

Press channel release button (figure 463, detail 8).

Tighten tuning control locknuts as tight as possible with the fingers. They must be securely tightened in order to retain correct adjustment.

With meter switch (figure 463, detail 29) in position 3, check meter readings for all channels (using the recorded readings previously obtained in tuning operations).

If meter reading for any channel has increased:

Press control box button preceding the button for the channel to be retuned.

Loosen locknut on power amplifier plate tuning control until it exerts only a slight pressure on cam.

Press button for channel to be retuned.

Adjust power amplifier plate tuning control for *dip* or *minimum* meter reading, with meter switch on position 3.

Press channel release button.

Tighten locknut on power amplifier plate tuning control as tight as possible with the fingers.

Press channel release button and check reading.

If decreased meter reading is found on position 1, retune oscillator plate tuning control (switch on position 1) as follows:

Press control box button preceding the button for the channel to be retuned.

Loosen locknut on tuning control until it exerts a slight pressure on cam.

Press button for channel to be retuned.

Adjust tuning control for a maximum reading.

Press channel release button.

Tighten locknut on tuning control as tight as possible with the fingers.



**Col** Press channel release button and check reading.

15

If decreased reading is found on position 2 or position 3, retune first or second harmonic amplifier plate tuning control as directed under procedure above for retuning oscillator plate tuning control. After all channels have been properly tuned, switch the set 10 or 12 times through all channels, then check meter readings on switch position 3 for each channel. If any change is found, locate it and retune the adjustment that has slipped, and tighten it securely.

When tune-up is completed, turn control shafts of "AUDIO" control and "RELAY" control completely counterclockwise. With set turned on and "T-R-REM" switch of control box in "R" position, listen to set determining if dynamotor noise is excessive. If in doubt, check dynamotor against one known to be quiet. When dynamotor test is completed reset both "AUDIO" and "RELAY" controls as previously directed.

Have airplane engine or engines started determining if excessive noise is being caused by any engine.

Make several contacts with other airplanes or control tower on as many channels as possible.

Secure rack lids.

#### Note

Much time can be saved and trouble averted by keeping a daily record of the meter readings of the I-139-A test set when plugged into the transmitter meter socket (figure 463, detail 28) with meter switch (figure 463, detail 29) on position 3. The daily record will be entered on a service log record sheet, as directed by Technical Order 08-10-105. Mistuned circuits, antenna or dynamotor defects for failure of transmitter tubes or parts are all reflected in this reading. Since all bands are detuned on any control on which the locknut has loosened, a reading for the lowest frequency channel will suffice. A clear picture of the operation of the set will be presented by such readings when recorded in this manner. Record the daily meter readings, taken on switch position 3, for lowest frequency channel. Allow a two-minute warm-up period. Compare the daily reading to detect any change indicating present or impending operating defects. (Refer to T.O. 08-10-105.)

**Col** SCR-595 (IFF) RADIO SET.

15

(The destroyer plug must be disconnected from the equipment during all tests). Turn on the radio set SCR-595 and make an aural test of the equipment with the headset plugged into the jack on the control units. No sound except possibly a series of clicks should be heard. If the set is found to be in self-oscillation (i.e., squittering) the receiver unit must be replaced.

Locate a properly adjusted test transmitter and test receiver near the antenna, the following three conditions must be met:

The signal produced by the test equipment must be heard with the headset plugged into the SCR-595 control unit headset jack.

The signal produced by the SCR-595 radio set must be heard on the test receiver.

The signal from the SCR-595 radio set must be heard through the test receiver without being blanketed by the signal transmitted directly to the test receiver by the test transmitter itself. The direct signal is too loud if the signal from the SCR-595 set has lost its own characteristic pitch, provided, of course, that the equipment is operating properly. Arrange the test equipment with these considerations as a guide.

With the test equipment operating, turn on the radio set and throw the control unit selector switch to 1. Listen on a headset plugged onto the test receiver for the characteristic signal produced by the test transmitter and the radio set.

Check the selector unit by moving the switch successively to each of the six positions, while listening at the test receiver. The characteristic signal should be heard at each position.

Test the operation of the "EMERGENCY" switch by throwing it to the "ON" position. The characteristic signal should be heard in the phones at the test receiver. Return this switch to its "OFF" position.

If a signal of sufficient strength is obtained, the radio set can be considered to be operating satisfactorily at one frequency. If a weak signal is obtained, try shifting the position of the receiver by a foot or two to make sure that it is not located in a "dead" spot.

While listening to the test receiver with the tone control set at its extreme clockwise position, slowly rotate the B band control on the test transmitter both above and below the original setting, meanwhile keeping the characteristic signal from the radio set tuned in on the test receiver by rotating its B band knob. Regular operation should be

Col secured at all settings between the two extremes  
15 at which the characteristic signal disappears. This proves operation is possible over a normal frequency range.

Check operation of destroyer buttons (destroyer plug disconnected) and proper centering of inertia switch plunger, when inertia switch is subjected to jarring.

Go over the entire accessible length of each cording harness cable and look for sharp bends, sign of excessive strain and cracked or frayed insulation.

#### MARKER BEACON RECEIVER.

Test marker beacon receiver tubes in the best available type of tube tester. They may be tested roughly on the model 685 tube checker. Replace any defective tubes. Reinstall good tubes in identical sockets from which they were removed.

#### Note

When testing VT-104, adapter "B" must be used in the octal socket of model 685 checker.

The relay should be checked by the following procedure:

Turn radio compass on and wait about 40 seconds for tubes to heat. Connect test indicator B-67 to the marker beacon receiver by means of cord CD-200. The switch on the panel of the test indicator should be held in the momentary contact or "ADJUST RELAY" position while the control knob is turned to vary the relay current. The current required to close the relay is normally 0.4 M.A. A deviation of 10 percent is permissible. As the current is reduced, the relay releases at 0.2 M.A. A deviation of 10 per cent in the release current is permissible. If the indicator lamp fails to light, remove receiver from case and check lamp circuit relay contacts. Clean relay contacts or replace lamp, if necessary.

The relay is readjusted as follows: (See figure 465.) Insert a piece of paper of two or three mms. thickness between the armature and relay coil pole pieces. Release screw S1 and exert a slight pressure on the armature directly above the pole piece. Turn the screw S1 until contact is just made and the indicator light goes "ON." Lock screw S1 in place, compensating for effect of lash in threads. Still exerting very light pressure against the armature, make sure that the paper can be withdrawn easily. This insures that there is no flexing of the armature and that the air gap is two or three mms. Adjust the tension of the armature spring SP by means of screw S3 until release occurs at 0.2

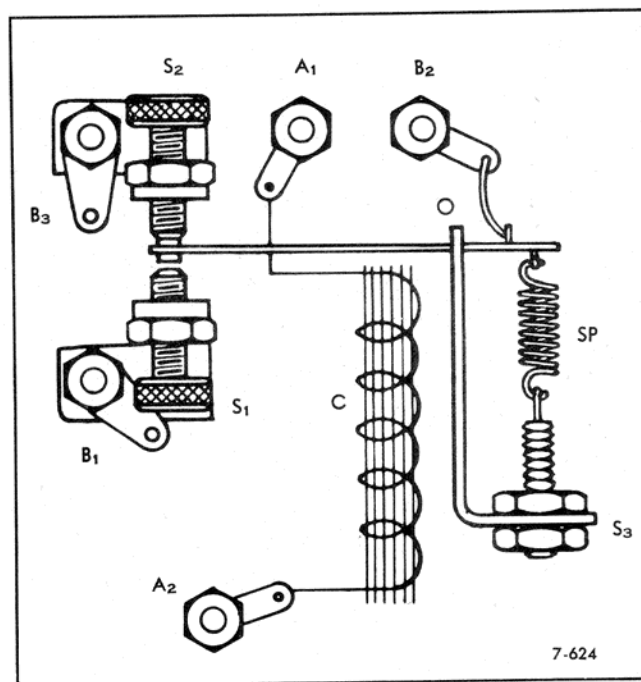


Figure 465—Marker Beacon Relay Adjustment

Col M.A. of relay current and lock screw adjustment  
15 S3. Screw S2 should now be adjusted so the relay closing current is 0.4 M.A. A deviation of 10 percent is allowable for both closing and releasing currents. However, it is important that the difference between the two should not be less than 0.20 M.A. for best performance.

To check the receiver tuning with test set I-76, place oscillator (BC-376) on the ground to the side of the airplane about 10 to 20 feet from the marker beacon receiving antenna. The test oscillator antenna should be extended to its full length and set parallel to the marker beacon antenna. The test oscillator battery switch should be turned on and the modulation set for 3000 cycles. Plug the test indicator (BE-67), which is also a part of test set I-76, into the jack on the front of the receiver marked "RELAY." Set the switch on the test indicator to the "TUNE RECEIVER" position and the millimeter will indicate the receiver output current when the latter is properly aligned. If the output is extremely weak, tune the receiver as follows:

Adjust, with a 1/8-inch blade screw driver, the screw adjustments in this order, for a maximum response on the output meter: "DET.," "R.F.," "ANT.," "R.F.," "DET." If the "ANT." and "R.F." adjustments are very far off, it is desirable to check from one to the other a couple of times and then tune "DET." last.



**Col** Be sure that the "ANT" capacitor is tuned to  
15 strongest response point and is not left at minimum capacity. This tuning should always be made with the receiver chassis in its case. Moving objects should be kept away from the vicinity of the antenna during the check.

#### INTERPHONE AMPLIFIER.

Test amplifier tube.

Check to insure that there is no interference between the cover assembly and the wiring.

Check for dirty or loose plug contacts.

Broken or corroded connections.

Check interphone dynamotor, remove end bells and inspect for:

Presence of carbon dust and dirt.

Free movement of armature.

Short, chipped, cracked or sticking brushes. Examine brushes to see that they have "worn in" properly and are free from hard spots in the contact surfaces. If brushes or commutator show signs of excessive wear replace dynamotor.

#### RADIO SET SCR-578-A.

Remove radio transmitter from bag and insert crank.

Connect a phantom antenna, type A-98, between antenna and ground connections on transmitter.

#### Note

If phantom antenna, type A-98, is not available, substitute a 31-ohm, 5-watt resistor in series with a 700-mmfd. condenser.

Set selector knob on transmitter in "AUTO 1" or "AUTO 2" position.

Rotate crank at approximately 72 RPM and adjust "TUNING" control to produce maximum glow in the "TUNE TO BRIGHTEST" indicator. Check "AUTO 1," "AUTO 2," and "MANUAL" positions for correct keying. "TUNE TO BRIGHTEST" indicator will flash off and on with the keying and will indicate that the transmitter is generating and delivering radio frequency power to phantom antenna. At 72 RPM, the speed indicator lamp should be lighted. Plug in signal light M-308-A and rotate selector knob until it reads "LIGHT" at any of the three positions: "AUTO 1," "AUTO 2," and "MANUAL." Check signal light on all three positions.

Make a visual check of all other units in accessory bag for possible mechanical damage.

**Col**  
15

#### Note

Ballon and hydrogen generator cans are sealed and should not be opened.

Parachute M-276-A should be unpacked and checked by authorized personnel at least once every 60 days.

Remove desiccator cap (lower right corner of face of transmitter), and inspect the bag of silica gel in desiccator well.

If silica gel has become "pinkish white in color," refill sack with new silica gel or reactivate the old as instructed in Section IV, paragraph 7. f. (1) (d). Dry the desiccator bag by heating.

#### CAUTION

DO NOT BURN CLOTH.

Place in desiccator well and screw on desiccator cap.

#### NAVIGATOR'S POSITION. RADIO COMPASS.

Test all tubes on tube tester. Replace all tubes found defective and reinstall serviceable tubes in identical sockets from which they were removed. Make sure they are firmly seated in their respective sockets and that all grid clips and grid cap shields are pushed down tightly and not shorting.

Check the mounting base screws, and the snap-slide fasteners which hold the radio compass unit to the mounting. Be sure the ground strap is securely clamped under the wing nut of the "GROUND" post.

Make sure that the antenna lead-in cord (CD-365) is secured and that ground braids at each end of the cord are bonded to the structure of the aircraft.

Check the tightness of the plugs (PL-108) and the ferrule couplings of the plugs.

Using a headset, check loop antenna operation on all three bands; then check compass operation and indicator response. Jar the radio compass unit to check for possible sources of noise.

Switch the complete equipment on and off to see whether or not the magnetic compass is affected.

Check for effects of other radio equipment in the airplane upon the communicational and navigational performance of the radio compass. Also determine the extent of any interference, if any, produced by the radio compass in the other radio equipment.

Switch to "LOOP" and tune to several transmitting stations, to see that the sensitivity is satisfactory. Operate "AUDIO" control to see that it properly controls the headset volume. Operate the

Col "LOOP L-R" switch. When this switch is turned  
15 "L" or "R" the bearing indicator pointers should rotate either left or right at a speed of one degree per second. On high-speed setting of loop control (switch is first pushed inward toward the panel and then turned to "L" or "R") the bearing indicator pointers should move, to either left or right, at a speed of 3-40 degrees per second. Place compass selector switch on "LOOP" and rotate the loop to the point of maximum headset volume. On a clear day, and at a location free from electrical disturbances, it should be possible to clearly receive radio range signals 50 to 100 miles distant and broadcast signals 100 to 250 miles distant depending upon station power and external interference.

With the "AUDIO" control fully clockwise, tune through each band with the engines stopped and note the noise level. Repeat the test with the engines running at various speeds. If any appreciable increase in noise is noted with the engines running at any speed, the aircraft shielding and bonding, or the battery circuit filtering, must be improved.

Switch to "CW" and tune "CW" signals from several stations. Each station should give a strong 800-cycle audio signal when tuned in. If not, the "CW-VOICE" switching relay (RE-12 SPDT contacts, 1280 ohms) and the "CW-VOICE" switch (S-24SPDT contacts) should be checked.

#### Note

Refer to Bendix circuit drawings in Technical Order No. 08-10-61.

Head the airplane directly toward a transmitting station. (Very accurate means should be taken to determine this heading.) Switch to "LOOP" and rotate loop for an azimuth reading of 175 degrees, as indicated by the bearing indicator pointer. Switch to "COMP," and the pointer should return to the zero reading at a rate of 35-40 degrees per second, if the A.C. inverter is delivering 115 volts. When the pointer arrives at zero, the overshoot should not exceed two degrees under any condition, and will usually be less than one degree. The amount of hunting of the indicator needle may be controlled by means of the screw driver adjustment, which is marked "AUTO SENS" on the panel of the radio compass unit. Adjust this automatic sensitivity control to obtain the desired amount of hunting but maintain sufficient sensitivity as follows:

Col Switch to "COMP" with radio compass still tuned  
15 to radio transmitting station and note azimuth reading of pointer.

Switch to "LOOP" and rotate loop so that indicator pointer is one degree from reading taken above.

Switch to "COMP" and again note azimuth reading of bearing pointer.

The readings taken in the preceding steps must be within 0.5 degrees for proper setting of "AUTO SENS."

Check the noise output of the radio compass when tuning between stations. This noise level is controlled by means of a screw driver adjustment, marked "THRES. SENS" and located on the front of the radio compass unit, access to it being obtained through a hole in the front panel. The adjustment procedure is as follows:

Switch to "ANT" and turn "AUDIO" control fully clockwise. Turn the "THRES. SENS" control to its maximum clockwise position.

Set the band selector switch on the center band, and tune the radio compass unit to a point near the middle of the band where no station is being received.

With the engines operating at normal cruising speed, reduce the "THRES. SENS" control until the noise received in the headset is of appreciable but not objectionable loudness.

Tune the radio compass unit throughout its frequency range to ascertain that the sensitivity is satisfactory at all points on all bands. It may be necessary to tolerate a somewhat higher noise level on the lower frequencies in order to obtain proper sensitivity on the higher frequencies.

The following table lists a number of typical voltage measurement tests that can be performed on the radio compass BK-22 relay panel. Coordination of the above chart with applicable wiring diagrams will greatly assist in locating trouble connected with operation of this equipment. If any given voltage does not check within 10 percent of the stated value, the associated circuits and components should be tested further. (Make these measurements between the indicated points with test set, using the scale indicated. "AUDIO," "LIGHTS," and "THRES. SENS" controls are to be fully clockwise. The "AUTO. SENS" control to be fully clockwise. The "LOOP L-R" switch is in the neutral position. The "SHIELD" post is grounded and the "ANTENNA" post is free, the loop is not rotating.)



Terminals Used	Scale Position of Function Selector Switch			Remarks
	"Comp"	"Ant"	"Loop"	
1. 2(+)-25 250 DC	.216 V.	225 V.	224 V.	Marker Beacon "B" supply
2. 15-Ground 100 AC*	60 V.	63 V.	62 V.	Clockwise motor-control lead
3. 22-Ground 5 AC	3.1 V.	3.1 V.	3.1 V.	"Lights" supply
4. 28-Ground 100 AC*	60 V.	63 V.	62 V.	Counterclockwise motor-control lead
5. 39-41 50 AC	24.8 V.	20.8 V.	24.8 V.	AC voltage across low impedance winding of Loop Drive Motor (MO-18)
6. 43-Ground 50 DC	15.5 V.	0 V.	15 V.	DC voltage across high impedance winding of Loop Drive Motor
7. 43-Ground 50 DC	2 V.	0 V.	2 V.	DC voltage across high impedance winding of Loop Drive Motor
8. 48-49 250 AC	115 V.	115 V.	115 V.	AC input voltage at load side of fuse
9. 57-Ground 50 DC	28.5 V.	28.5 V.	28.5 V.	Low voltage supply for marker beacon receiver
10. 60-Ground 50 DC	28.5 V.	28.5 V.	28.5 V.	DC input voltage at load side of fuse
11. 41-44 50 AC	47.5 V.	0 V.	47.5 V.	Autosyn supply voltage
12. 58-Ground 50 DC	0 V.	0 V.	0 V.	Low potential end of power ON-OFF relay (RE 8)
13. 59-Ground 25 DC	14.5 V.	14.5 V.	14.5 V.	High potential end of power ON-OFF relay (RE 8)

\*With series Capacitor

Figure 466—Voltage Measurement Tests on Radio Compass Relay Connection Panel BK-22-A

Col ALL CREW MEMBERS' STATIONS.

15 Check interphone jack box for:

Proper action of switch.

Dirty or loose switch, jack and plug contacts.

Broken or corroded connections.

Deterioration of any parts.

Loose control knobs.

Check *microphone and headset cords* for intermittent contacts and for corrosion and oxidation of plug contacts and condition of cord-holding clips.

Test operation of all "PUSH TO TALK" buttons.

Make operating test on all positions of interphone jack box.

Check headsets, type HS-23.

Check receivers, if weak, by suspending diaphragm on edge from pole piece of receiver for magnet strength (good receivers will hold diaphragm). If weak, replace headset and have old one repaired at Signal Repair Depot. Always check both receivers to see that they have the same output level.

Replace headband if badly worn.

Col Replace PL-54 if outer casing is badly worn or  
15 broken. Check linen cord and shellac.

Check rubber cushions, see that inner surface is not broken; if surface is broken, replace cushion, as perspiration, etc., will cause chafing.

Col

**PHOTOGRAPHIC EQUIPMENT**

16

**50-Hour Inspection**

Inspect camera junction box for any loose connections, if box is installed.

**100-Hour Inspection**

Lubricate tandem cradle rotating points with graphite grease, Specification No. AN-G-6.

Col

**ENGINE CONTROLS**

20

**25-Hour Inspection**

Inspect throttle, mixture, intercooler temperature, and propeller controls, from levers in pilots' compartment through all rods, cables, linkage, support brackets, fair leads, and pulleys. Inspect for full and free movement, lost motion, bent rods, frayed cables, loose, broken or misaligned pulleys, loose or missing bolts, nuts, screws, cotter pins, etc. See that linkage is properly adjusted. Controls should operate with uniform tension throughout their full range.

Col See that all adjustment or position locking devices  
20 function properly and that all levers are adjusted to prevent creeping. Clean and lubricate all moving connections and bell cranks with oil, Specification No. AN-VV-O-446.

Control cables that are found to be frayed (individual wires broken) will be considered serviceable unless there are more than six broken wires in any one-inch length of the cable. The number of broken wires will be carefully noted, particularly where the cables pass over pulleys or guides.

#### Note

When replacing a control cable, a thread line should be soldered to the end of the cable to facilitate reassembly.

#### 50-Hour Inspection

On airplanes operating from extremely dusty landing fields or through dusty (desert) areas, control cables will be thoroughly cleaned where they pass over pulleys, or through fairleads, and at other points of contact throughout the airplane, and will not be coated with lubricant or rust preventive compound.

In coastal or insular areas where conditions are conducive to corrosion, clean cables at points of contact and coat with rust preventive compound, Specification AN-C-52.

Col  
21

### ENGINE INSTRUMENTS

#### 25-Hour Inspection

Visually inspect the fuel and oil pressure gage transmitters and their connections. Make sure that all nuts and screws are tight. Check the systems thoroughly for leaks, especially if the gages read other than zero with the engines off, as this is usually indicative of a loss of filling fluid. Do not overlook any possible leakage occurring at the gage fitting or at the cap on the bleeder valve at the back of the gage. Particular attention should be given to the flexible connectors, at the hose connector fittings, for leaks. Any connectors showing evidence of leakage should be replaced. Check the line between the instrument and the transmitter to see that no sharp bends, kinks, or loose suspensions can give rise to line failure through vibration.

During extremely cold weather, trouble may be experienced with the oil pressure gage due to congealing of engine oil in the line between the engine and the oil pressure transmitter. To overcome this difficulty, fill the oil pressure line with compass fluid or other low viscosity fluid, according to the following procedure:

Every 25 hours or after four flights, whichever is sooner, connect a suitable filling device to the top

Col of the casting, at the brass plug, and fill the trans-  
21 mitter and line with compass liquid.

#### 50-Hour Inspection

Check oil and fuel pressure instruments and lines for security of mounting. Check all lines and connections for proper anchorage, flexibility, and leaks. Check dial and pointer for luminosity.

Check the readings of the manifold pressure gages with the station barometer. If they differ more than 0.4 inch Hg replace and turn in defective instrument for bench work.

Check the thermocouple thermometer indicators as to the zero positions. One method of doing this is to open the circuit at some convenient point, for example, at the thermocouple, or by removing one of the eye terminals from one of the studs on the back of the indicator. After the circuit has been so opened, the instrument should indicate the temperature of the cockpit. The temperature of the cockpit is found by placing a standardized mercury thermometer closely adjacent to the indicator and allowing sufficient time for the mercury thermometer to attain the correct cockpit temperature. Adjust the disconnected indicator to agree with the mercury thermometer reading. Rotate the zero adjusting screw, located in the glass face of the indicator, to the right or left until the pointer indicates the same temperature as on the standardized mercury thermometer. The reading should be taken again after 15 to 30 minutes to be sure to obtain steady setting conditions. After setting the adjusting screw, close the circuit at the point previously opened and the indicator should indicate correctly the temperature at the thermocouple.

All thermocouple connections should be made clean and tight; otherwise "contact resistance" will be introduced and the readings will be incorrect. The connectors should be anchored with insulation tape or small clamps, to prevent their breaking due to vibration, and should be taped to prevent shorting the engine.

When inspection of these indicators shows evidence of moisture having leaked around the zero adjusting screw or the cover glass into the case, the indicator should be replaced and sent to the depot for necessary servicing.

#### CAUTION

The thermocouple leads must not be lengthened or shortened as they are of a definite resistance and enter the calibration of the indicator. When installing, it is often desirable to trace out thermocouple leads from the engine end. A convenient method of doing this is to use a



Col spare thermocouple attaching it to the  
21 lead to be traced and then heating it with a soldering iron. Enough voltage will be generated to be easily seen on the indicator. When the leads on either side of the fire wall require replacement on airplanes equipped with fire wall connectors, both portions will be replaced. A standard lead of correct total length will be cut and the cut ends of the two lengths soldered to the connector fittings. This is necessary to maintain correct resistance.

### 100-Hour Inspection

Replenish the oil and fuel pressure gage lines, between the indicator and the transmitter, with compass liquid by following the procedure outlined in section IV, paragraph 7. a. (15). This is done to replace any liquid that may have been lost from the system through gradual seepage at the fittings.

### Engine Change Inspection

All installed aircraft thermometers will be inspected at each engine change to determine for which purpose they are being used. If not already marked, each thermometer will be properly identified by either name and data plate or drawing number. Identification markings will be over 1/16 inch wide, and will be made by using aircraft enamel, Specification No. AN-E-3, or lacquer, Specification No. AN-TT-L-51.

## Col IGNITION AND ELECTRICAL EQUIPMENT 22 25-Hour Inspection

### MAGNETOS.

Remove the "Y" ground terminal connection at each magneto. Check the compression spring for proper alignment to eliminate grounding, and inspect the spring cap for proper security. Remove the rear cover. Clean and wipe the points and the interior of the case with carbon tetrachloride to remove condensed oil and water vapors.

### SPARK PLUGS.

The gap clearance of all spark plugs installed in airplanes which are operated at high altitudes will be checked and reset to .012 inch (+ .002 inch - .001 inch). A roughness at high altitude with relatively smooth operation at lower altitude indicates the need of regapping. Elbow terminals and shielding nuts will be checked for security. When checking the elbow assembly of shielded plugs *extreme care must be exercised, to see that the barrel is not rotated with respect to the shell, since this will change the gap setting.*

Col Use elbow wrench (Wright No. 800630). Under  
22 no conditions will the tightness of the elbow be determined by a twisting motion applied to the body of the elbow.

### SWITCHES.

When properly installed and operated, the battery circuit solenoid switch should require little or no attention between engine overhauls. No lubrication is required at any time. In event the circuit controlled by the switch becomes inoperative, short the terminals of the switch to determine whether the switch is at fault, in which case it will be replaced.

Inspect landing gear limit switches for security of connections and for proper operation.

Remove cover from switch panel and inspect for security of connections, freedom of operation, and general condition. Remove all accumulated dust and foreign material with air blast.

Inspect all other electrical switches in the airplane for security of connections, correct operation, and for general condition. Where practicable, inspect condition of switch contacts.

### LANDING GEAR ELECTRICAL RETRACTING SYSTEM.

The green "LANDING GEAR DOWN" signal light on the instrument panel should be "ON" when all landing gear is down.

The red "TAIL WHEEL LOCK" signal light on the instrument panel is "OFF" when the tail wheel is locked.

### NOTES:

Adjustment is noted in handcrank turns between limit switch electrical cutoff and mechanical stop engagement.

Bumper compression and stop contact required only with Eclipse Type Retracting Motor installations for landing gear and tail gear.

Do not operate the tail gear or landing gear retracting mechanisms with the handcrank unless the land gear switch is in the "OFF" position.

Adjustments given are for all types of limit switches.

If any retracting motor fails to operate, check respectively the fuse, the limit switch, broken or loose connections, and for defective motor.

If the motor runs, but the gear fails to operate, check the two conduit connections, on the side of the motor, controlling the magnetic clutch. These connections should be tight at all times.

Lubricate the retracting motors at each 25-hour inspection period by placing two or three drops of lubricating oil, Federal Specification No. VV-O-496, grade SAE 20, in the oiler at the commutator end of the motor.

LOCATION	POSITION	RETRACTING MOTOR TYPE	LIMIT SWITCH ADJUSTMENT
Landing Gear	Up	Eclipse	$1 \pm 1/8$ Turns Handcrank
Landing Gear	Up	General Electric	$1 \pm 1/8$ Turns Handcrank
Landing Gear	Down	Eclipse	2 to 4 Turns Handcrank
Landing Gear	Down	General Electric	$1/2 \pm 1/8$ Turns Handcrank
Tail Gear	Up	Eclipse	$1 \pm 1/8$ Turns Handcrank
Tail Gear	Up	General Electric	$1 \pm 1/8$ Turns Handcrank
Tail Gear	Down	Eclipse	2 1/2 to 3 Turns Handcrank
Tail Gear	Down	General Electric	$1/2 \pm 1/8$ Turns Handcrank
Bomb Door	Closed	Eclipse	1 3/4 to 2 Turns Handcrank
Bomb Door	Closed	General Electric	1 3/4 to 2 Turns Handcrank
Bomb Door	Open	Eclipse	1 3/4 to 2 Turns Handcrank
Bomb Door	Open	General Electric	1 3/4 to 2 Turns Handcrank
Wing Flap	Up	Eclipse	1/4 Turns Handcrank
Wing Flap	Up	General Electric	1/4 Turns Handcrank
Wing Flap	Down	Eclipse	1/2 Turns Handcrank
Wing Flap	Down	General Electric	1/2 Turns Handcrank

Figure 467—Limit Switch Adjustment Chart

Col  
22

**CAUTION**

Do not use lubricant other than the one specified. Avoid over-oiling. Keep the commutator free from oil at all times.

**Note**

Inspect the commutator and the brushes after every flight above 20,000 feet and every 25 hours flying time. Brush wear is very rapid at high altitude because of increased sparking.

Brushes in the type P-I generator will be replaced if their wearing length (distance from face of brush to shoulder on brush) is less than 3/16 inch. This condition is approached when the top of the brush on the side opposite the spring is 1/16 inch below the top of the brush holder.

**50-Hour Inspection**

**WIRING.**

Inspect the safetied generator cable connector nuts. If the tape has unraveled or become damaged, the old tape will be removed and the connector nuts will be resafetied by wrapping four turns of friction tape on the connector nut, in a clockwise or tightening direction, continuing the wrapping of the tape onto the cable, making four or five turns on the cable. Secure the tape by tying a single turn of lacing cord over the tape on the cable, and shellac.

Inspect all wiring for proper anchorage of conduit nuts, security of bonding leads, and terminal box covers. Also inspect the condition of connections, insulation, terminals, exposed ends, contacts, and grounding connections. See that no

Col leads are anchored to the fuel lines, vent lines or  
22 engine controls. Leads should be secured to prevent undue wear or fatigue caused by swinging.

**Note**

When replacing ignition wires in conduits, securely attach the new wire to the wire being removed. Dust the new wire with talc to facilitate replacement and use a gentle pulling motion to draw it into the conduit. Do not jerk. Leave adequate wire on each end to make necessary connections. When resoldering any part of the ignition manifold assembly, lead or silver solder, U. S. Army Specification No. 57-99-1, 1/8-inch diameter rod will be used. Extreme care will be exercised to avoid burning any adjacent cable.

**STARTERS.**

Check for loose electrical connections. Inspect starter motor brushes for satisfactory bearing on commutator and for free movement in the brush holders. Binding brushes and brush boxes should be wiped clean with a cloth moistened with unleaded gasoline. Worn brushes should be replaced. Maximum permissible brush wear is 3/16 inch from a new length of 1/2 inch.

The brush spring tension should be 25 to 28 ounces on a new brush and 15 to 19 ounces on a brush worn to 5/16 of an inch.

Seat brushes by inserting a strip of No. 0000 sandpaper between the brush and the commutator, with the sanded side next to the brush, and



Col pulling in the direction of rotation. Repeat this  
22 operation until brush is completely seated. When installing brushes, use caution to assure that the insulation around the brush leads protects them from the motor housing.

**CAUTION**

Do not use coarse sandpaper or emery cloth. Remove sand or metal particles with compressed air.

Inspect brush springs for proper tension. Replace if tension is less than 36 ounces when compressed to a length of 7/16 inches.

Inspect commutator for foreign matter or roughness, and clean if necessary, using No. 000 sandpaper.

See that safety wiring is installed where required.

**RETRACTING MOTORS.**

Check for security of mounting and safety wiring. Remove window strap and check for worn or binding brushes, and loose or dirty connections.

The maximum permissible wear of the brushes is 3/16 from a new length of 9/32 inch. However, brushes should be replaced before the maximum wear limit is reached in order to assure proper operation until the next inspection period. Clean with a cloth moistened with unleaded gasoline. Brushes should be a free fit without excessive side play in the brush boxes.

**CAUTION**

Do not use coarse sandpaper or emery cloth. Remove sand or metal particles with compressed air.

Check condition of commutator. If the commutator is rough or dirty, smooth and polish with No. 0000 sandpaper. (Never use emery cloth.)

Remove and check the brush spring assemblies for required tension when inspecting brushes. Replacement should be made if the tension is less than 38 ounces when the spring is compressed to 9/16 inch as measured from the top of the metal spring retainer.

Clean and tighten all connections and replace any defective wiring.

**HYDRAULIC FLUID PUMP MOTOR.**

Follow same procedure as shown above for retracting mechanism motors.

**SOLENOID SWITCHES.**

Inspect for security of mounting. Check all electrical connections for security of leads.

If the battery or starter relay solenoid will not operate, inspect the solenoid leads for breaks or poor terminal connections. Inspect the solenoid

Col circuit for grounds. If arcing occurs, inspect the  
22 contact surfaces for pitting. When properly installed and operated, the battery and starter circuit control relay should require little or no attention.

Check the battery and starter relays for security of mounting, for cracked housing or mounting bracket, and for loose or faulty electrical connections.

**Note**

At every engine overhaul period, the relay should be removed from the airplane and returned to depot for overhaul.

**PUSH BUTTON SWITCHES.**

Check the shaft and contact pins in the push-button control switches for binding. Examine the contact strips, with and without the control knobs depressed, to insure good contact between the contacts and pin. Check knobs and retainer nuts for tightness.

**WARNING SIGNALS.**

Check switches for security of mounting.

**CAPACITORS.**

Test for breakage of internal connections and for blown fuses caused by internal short circuits.

**MAGNETOS.**

Examine magnetos for cleanliness and security of mounting.

Check for security and connection of the magneto ground wire.

Remove breaker cover and clean breaker housing.

Inspect magnetos for damaged cam followers, damaged breaker felts or cushions and for weak or broken breaker arm springs.

Check for worn or loose cams or cam bearings.

Check cam lubrication. Under all normal conditions there is ample oil in the oil reservoir to last between overhauls. If oil is present on inside of gear housing and on breaker assembly, it should be removed. Oil around breaker points can best be removed with a flexible wiper such as a pipe cleaner. This permits easy removal of oil on front of points, and by forming a hook at end of cleaner, provides access to any oil accumulation on back of points.

**CAUTION**

Care must be taken to remove any lint from the contact surface of the points.

Lack of cam lubrication is indicated when no oil film exists on cam, when cam follower has a grayish-white color instead of a reddish-brown, moist-appearing surface. If lack of cam lubrication

Col 22 tion exists, magneto must be removed from engine for overhaul. A small deposit of reddish coloring, easily removed from cam, is not sufficient for removal of magneto.

Inspect magneto distributor for cracked head or rotor, sticking or broken brushes and for signs of arcing. Check mounting screws for tightness. Replace head, brush, or rotor as required.

Inspect breaker points. During normal operation a small amount of pitting and burning of points may occur. This is permissible unless visual inspection indicates that points are so badly burned that they may shortly interfere with proper operation of the magneto. In this case the points must either be replaced or properly dressed with American Bosch dressing tool TSE5229.

### CAUTION

Never use a file, sandpaper or emery cloth for dressing breaker points, because they leave minute particles imbedded on the contact surfaces of the points, and this will cause an excessive amount of arcing and pitting.

When checking points, if evidence of arcing is found (points having smoky or burned appearance), check condenser for proper functioning. Replace if defective.

Check the timing and synchronization of the magnetos. The instant at which contact points start to open on No. 1 cam lobe (indicated by red dot) a straightedge, placed across the step of the cam, should coincide with registering marks on rim of the gear housing. A maximum permissible variation is  $\frac{1}{32}$  inch on either side of the registering marks. If this limit is exceeded, correct in the following manner.

Facing the front of the engine, turn the propeller counterclockwise until the cam follower is in the cam well preceding No. 1 lobe. Place a straightedge on the step of the cam and jar the propeller in a counterclockwise direction until the straightedge just lines up with the center of the timing marks on the rim of the gear housing. Loosen the adjustable contact bracket locking screw and shift the bracket, by means of the eccentric screw, until contact points exert a slight pressure on a .001-inch thickness gage. Secure adjustable contact bracket and recheck with the thickness gage to make certain that the securing operation did not change contact position.

When setting is correct the thickness gage will become free just as the straightedge coincides with timing marks, when propeller is turned counterclockwise, indicating that contact points on No. 1 cam lobe are just beginning to open. Make certain that the locking screw is securely

Col 22 tightened and recheck the adjustment by moving propeller as outlined. After final adjustment, recheck synchronization of both magnetos to the engine timing marks and replace breaker cover.

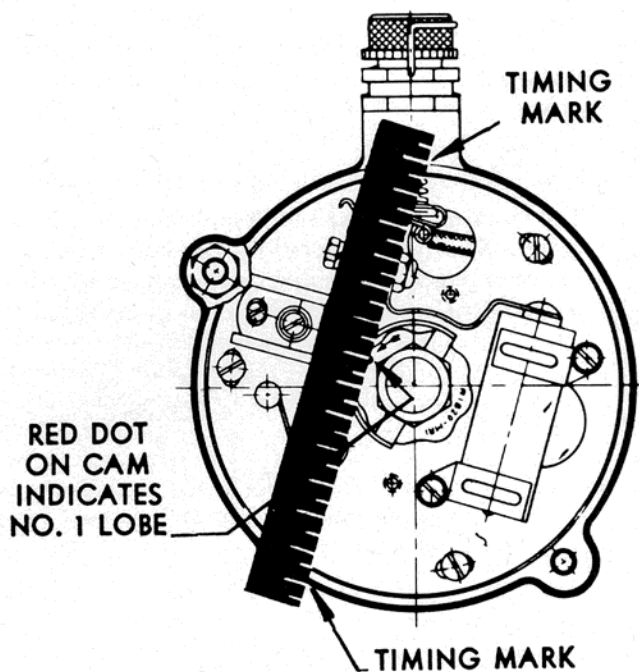
See that safety wire and pins are installed where needed.

### GENERATORS.

Inspect generators for security of mounting. See that all connections and terminals are in good condition and that safety wire is installed where necessary.

If the commutator is rough or dirty, smooth with No. 000 sandpaper (*never use emery cloth*). If badly scored, pitted, or eccentric, the commutator should be resurfaced. (Repair depots only.)

Remove the generator brush bands and check brushes for wearing, sticking, loose connections, and for excessive arcing between brushes and commutator.



STRAIGHT EDGE PLACED ACROSS STEP OF TIMING COLLAR MUST COINCIDE WITH TIMING MARKS WHEN CONTACT POINTS START TO OPEN ON NO. 1 CAM LOBE. THIS WILL GIVE CORRECT GAP. PERMISSIBLE LIMITS ARE  $\frac{1}{32}$ " ON EITHER SIDE OF TIMING MARKS.

7-118

Figure 468—Magneto Timing

Brushes should be replaced before their maximum wear limit is reached in order to assure proper operation until the next 50-hour inspection. When replacing a worn brush in the type P-1



*Col* generator, the new brush should be properly seated by inserting a strip of No. 000 sandpaper between the brush and the commutator, with the sanded side next to the brush, and pulling it in the direction of rotation, being careful that the sandpaper is kept in the same contour as the commutator. Repeat this operation until the brush is fully seated. Binding brushes should be wiped clean with a cloth moistened with unleaded gasoline.

Check for the presence of oil in the generator. If noted, remove the generator and check engine oil seal for leakage.

If the generator head screws are loose, unsafety, tighten, and safety. In tightening, be sure that the screws do not bottom in the yoke or field housing.

Clean and tighten all connections and replace any defective wiring.

#### CONTROL UNITS.

Inspect control units for security of mounting, excessive arcing, cleanliness, condition of contact points, proper safetying, etc. Inspect terminals, cables, and connections for security of attachment and general condition.

Check condition of vibration absorption mounts.

Inspect contact points and clean if necessary. Dirt generally can be removed by inserting a piece of clean paper between the contacts, pressing the contacts together, and pulling out the paper. Be sure not to leave paper lint between the contacts as this will reduce the voltage. Opening the contacts and then letting the spring snap them shut may help to remove lint.

#### CAUTION

When inspecting the contacts the line switch must be open.

#### 100-Hour Inspection

##### SPARK PLUGS.

All spark plugs will be removed at 100-hour intervals and replaced with new or reconditioned plugs of an approved type. In case it becomes necessary to replace spark plugs prior to the 100-hour inspection, the operating time since the plugs were installed will be obtained and this operating time furnished whenever unsatisfactory reports are submitted.

#### 200-Hour Inspection

##### RETRACTING MECHANISM MOTORS.

Remove and check clutches for slippage. The clutch for the landing gear retracting, bomb door retracting, and flap operating mechanisms shall be set to conform to the clutch settings given under "Adjustments" above.

*Col* Clutch setting values, as given in the table under  
22 Adjustments above are to be made on the basis of breakaway torque.

With the motor and clutch at room temperature start motor with test stand brake loose. Tighten brake until motor clutch starts to slip. This is evidenced by stoppage of the output shaft. The maximum torque reached before the shaft stops shall be taken as the clutch setting. Acceptable settings shall be as specified for the unit in question  $\pm 5$  percent.

To prevent excessive temperature increase, do not permit the clutch to slip any longer than necessary. Readjust the clutch if the breakaway torque is not in accordance with the specified values as given in the table below. Allow the motor to stand a minimum of 30 minutes from the time of the first check before checking again. Recheck as instructed above. If additional adjustments are necessary, they shall each be followed by a cooling period and rechecked again. Clutch settings for reverse travel should also be checked as outlined above. No attempt should be made to adjust clutch settings without the use of a torque measuring device.

.012 inch + .002 inch  
- .001 inch.

Unit	Approx. Oper. Time (Seconds)	Clutch Setting Breakaway Torque
<b>MAIN LANDING GEAR</b>		
Eclipse Type 1073	raise-45	1200 pound-inches
G.E. Type 5BA50FJ2B	raise-45	1050 pound-inches
Eclipse Type 785	raise-45	850 pound-inches
G.E. Type 5BA50FJ2A	raise-45	850 pound-inches
<b>TAIL GEAR</b>		
Eclipse Type 1227-1	raise-45	400 pound-inches
G.E. Type 5BA50FJ3A	raise-45	400 pound-inches
<b>BOMB DOORS</b>		
Eclipse Type 1073-1	raise-25	1200 pound-inches
G.E. Type 5BA50LJ7	raise-25	1200 pound-inches
<b>WING FLAPS</b>		
Eclipse Type 786-1	raise-45	600 pound-inches
G.E. Type 5BA50FJ4A	raise-45	600 pound-inches

Note: The dash number following the type number for the Eclipse motors refers to the model designation.

Figure 469—Retracting Motors Clutch Settings

#### Note

Operating time is based on battery voltage while under charge (28.5 volts) and this must be taken into consideration when checking with engines stopped or with ground batteries.

#### 250-Hour Inspection

Check inverters for output and satisfactory operation.

Check fluorescent rheostat control.

Boxes for output, satisfactory operation, and starting of the fluorescent lamps.



Col 22 Check the fluorescent lamp assemblies for satisfactory operation. If ends of lamp are dark, replace.

Check operation of lamp starting switches.

#### 500-Hour Inspection

Replace fluorescent lamps and check for operation. Change the lamp starting switch if its operation is sluggish.

Replace the inverter vibrator element, and check for operation.

Col 23

#### FUEL SYSTEM

##### 25-Hour Inspection

Check carburetor attachment bolts for tightness.

Lubricate the carburetor throttle shaft bushings using oil, Specification AN-O-6. Inspect parting surfaces between body castings, test screws with screw driver for tightness.

Inspect the fuel pump relief valve for leaks, proper operation, and for security of mounting and proper safetying.

Remove and clean all the fuel strainer screens (mounted on forward inboard side of each fire wall); inspect for defects. Clean strainer bodies. Replace strainer screens, plugs, and drain valves, and resafety.

#### Note

Fuel supply lines do not have to be disconnected to clean strainers.

After the above operations have been completed, and while the fuel strainer is filled with air, disconnect the flexible hose in the vent line at the carburetor. Then apply fuel pressure with the electric boost pump, and observe the action of the vapor eliminator. It should be possible to notice the rush of air being expelled, and then cease when the fuel level raises the float and shuts off the vent passage. There should be no fuel flow from the vent line other than just a few drops, which is normal seepage.

Inspect the hand primer pump for leaks.

With fuel booster pumps on, inspect all fuel lines for leaks, particularly at connections and at sharp bends. Check for cracks, security of line anchorage, and wear due to loose clamps, vibration, or chafing. Inspect hose connections and clamps for tightness and condition.

Inspect fuel transfer valves for security of mounting, and evidence of leakage at line connection.

#### 50-Hour Inspection

Drain carburetor regulator units, air chambers, and fuel control units through plugs in bottom.

Col 23

#### 100-Hour Inspection

In lubricating Pesco engine-driven fuel pumps, fill the seal chamber of the fuel pumps approximately half full of lubricating cup grease, medium, Federal Specification No. VV-G-681. Apply through zerk fittings in one of the 1/8-inch pipe tapped connections next to the engine pad. Do not apply grease through the drain openings.

Do not apply grease through the drain openings of the Thompson fuel pumps. The drive shaft and coupling parts are lubricated by the engine oil which finds its way on to the pump drive. The oil seal prevents leakage of oil out through the fuel drainage channels.

#### At Engine Change

If replacement items can be obtained, remove and replace all fuel pumps (except those having less than 100 hours of service since last overhauled). Where replacements are not available, the pumps may be continued in use until a replacement can be secured.

Col 24

#### OIL SYSTEM

##### 25-Hour Inspection

Inspect all oil lines for leaks, particularly at connections and at passages through fire walls and other structures. Check for security of attachments, dents, cracks, chafing, etc. All hose connections and clamps should be inspected for general condition and for proper location.

Remove the Cuno oil filter cartridges from the engines. Clean and inspect as follows:

All automatic Cuno oil filters and the compartments in which the filters are installed will be cleaned each time the filter is removed.

The filters will be washed in gasoline and then dipped in new engine oil and turned by hand in order to lubricate the discs. The lubrication of the disc is necessary in order that the filter will operate automatically as soon as the engine is started. If the filter is not lubricated, it will in most cases fail to turn for some time after the engine is started. Replace the filter immediately after dipping in engine oil.

Filter cartridges should rotate through 360 degrees with a maximum torque variation of 50 percent. Hard spots or points of catching are cause for rejection.

The cleaner blades must be straight and flat. They should not show angular displacement in the plane of the discs in excess of eight degrees from the midposition when the cartridge is rotated. Bent or torn blades, unless such bending is limited to the extreme edge of the part of the blade most remote from the discs, is cause for rejection. In an emergency a torn or badly bent blade may be carefully



Col removed, making sure that all parts are recovered  
24 and that no other parts are damaged, and the filter used until a replacement is available, provided no other cause for rejection exists.

The filter discs must be flat, evenly spaced, and free from burrs or nicks.

In winterized airplanes, the lagging which covers the oil lines should be inspected for general condition, and repaired if necessary.

### 50-Hour Inspection

Inspect oil coolers for security of mounting, general condition, and evidence of clogging.

Inspect magnetic sump plug for trapped particles.

Check the operation of the oil dilution system. Disconnect both the inlet and outlet of the oil dilution valve and connect a pressure line from a test fuel pump to a valve inlet. Apply a fuel pressure of approximately 26 pounds per square inch from a test pump and use a suitable container to receive the flow from the valve; operate the corresponding switch in the cockpit momentarily and check for positive valve operation. Remove the lock wire and plug from the bottom of a valve and check for leakage with a pressure of 26 pounds per square inch, watching both the valve outlet and bottom hole. Leakage should not be in excess of 10 drops per minute.

Inspect oil tanks for security of mounting, signs of leakage, deterioration, condition of padding and proper location of padding between tanks, support straps, and mountings. Check for proper tension of support straps and proper anchorage of oil lines leading from the tanks.

### At Engine Change

Oil lines and oil tanks will be drained and thoroughly flushed and cleaned as follows:

Oil lines will be disconnected, hose connections will be removed and inspected for any trapped debris, and the system will be thoroughly flushed and cleaned with kerosene, Federal Specification No. VV-K-211.

Due to the baffling in the hopper type oil tanks, a complete inspection of the tank for dirt, sludge, and metal particles is impossible. Therefore, during the flushing operation, the oil outlet at the bottom of the hopper will be disconnected and kerosene poured through the tank until all traces of dirt and debris have been eliminated.

At each fourth engine change (or, at the discretion of the local engineering officer, at any intermediate engine change) and at all engine changes made necessary by internal engine failure, every effort will be made to remove all foreign matter and to

Col clean the tanks as thoroughly as possible. Cleaning  
24 and flushing will be accomplished with kerosene or steam.

## WARNING

When using kerosene in the cleaning operation, precautions against fire hazard will be observed at all times.

All oil temperature regulators will be thoroughly cleaned by flushing with clean kerosene and re-installed. The oil temperature regulator will be replaced at any engine change resulting from an internal engine failure.

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## COOLING SYSTEM

### 25-Hour Inspection

Inspect engine cowl flaps and magneto cooling tubes for cracks or other damage, proper alignment and security of mounting.

Check cylinders for damaged or broken fins. Lubricate cowl flaps and the flap control system with oil.

## VALVES

### 300-Hour Inspection

Clearance between the rocker arms and the valve spring upper washers will be checked with the valve in the closed position. Adjust as directed in section IV, paragraph 6.

Check for broken springs and for condition of rocker box cover gaskets.

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## MANIFOLDS AND SUPERCHARGERS

### 25-Hour Inspection

INTAKE PIPES.—Inspect and tighten engine intake pipe packing nuts at first 25-hour inspection after engine installation. *Do not tighten excessively.*

## CAUTION

No further tightening of packing nuts should be attempted after first 25-hour inspection.

EXHAUST WASTEGATES.—Check exhaust wastegate for warpage, bending, or binding. To make this check, disconnect linkage rod from wastegate arm and move gate from fully open to fully closed position. If any binding or friction is noticed, straighten wastegate or replace it. Apply penetrating oil to wastegate nut and spindle.

WASTEGATE MOTOR.—Check AN connector to see that it is inserted properly and is tight.

Col  
27

**CAUTION**

Never disconnect AN connector of waste-gate motor when inverter is on; this is apt to damage the amplifier.

Make sure motor is mounted solidly and has not shifted its position.

**GOVERNOR AND FLEXIBLE DRIVE.**—Inspect AN connector on governor to make sure it is properly inserted and tight.

See that the nut on flexible-drive connection is not cross-threaded and that it is tight.

Check governor mounting to make sure that governor is held solidly in place and has not shifted its position.

**OPERATION OF AMPLIFIER AND WASTE-GATE MOTOR.**—Plug in external power supply. Carefully check voltage of external power supply. (Voltages higher than 28.5 volts D.C. may result in weakened or burned-out amplifier tubes.) Turn on inverter switch. Set dial of turbo boost selector at "8." Remove AN connector on pressure-trol and plug in the special test potentiometer in place of pressure-trol. Turn knob on test potentiometer until wastegate is fully closed.

**Note**

If the suggested test potentiometer is not available, the "jumper" method can be used without removing the AN connector of the pressure-trol. Refer to Section IV, paragraph 6. b.

**CLEARANCE OF LINKAGE ROD.**—Check to see that there is at least 1/2-inch clearance between the linkage rod and any structural part of the airplane for all positions of the waste gate. Since the exhaust stack and turbine move backward an appreciable amount when heated, this much clearance is necessary to keep the linkage from binding.

**CLEARANCE OF WASTEGATE FROM STOP.**—With wastegate motor in fully closed position, the wastegate should be approximately 3/32 inch away from the stop inside the exhaust pipe.

**WASTEGATE POSITIONS.**—Remove test potentiometer used for closing waste gate, and replace pressure-trol AN connector. If jumper method was used, remove jumper and replace "J" box cover. Turn dial of turbo boost selector to "8" and look at exhaust wastegates. At sea level, or at altitudes slightly above sea level, the waste gates should be open or almost open when the engines are not running, even with the dial set at "8," but at bases of higher altitude, the wastegates will be partly closed when dial is turned

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to "8." Because of the small guide key in the pressure-trol AN connector receptacle, great care should be used to insure that the plug is properly matched with the receptacle when it is inserted.

**PRESSURETROL CONNECTIONS.**—Inspect pipe or hose which connects pressure-trol to induction system duct. Check for leaks or cracks in hose and for loose clamps. A leak will result in erratic control and will introduce manifold pressure "hunting" at certain powers or altitudes.

**INDUCTION SYSTEM.**—Check for leaks in rubber couplings in induction system ducts. Also check gasket between duct and the turbosuper-charger compressor housing. Check induction system for security of attachment.

Inspect turbo air intake ducts for obstructions such as dirty filters.

Check for loose or worn linkage on filter control gates.

**TURBO BOOST SELECTOR.**—Check AN connector to be sure it is properly inserted and tight.

Turn dial of turbo boost selector to "10." Wastegates should go to half-closed position or beyond.

Turn dial to "0." Wastegates should open fully. Test operation of dial on turbo boost selector to see that it turns freely but not loosely. It should be tight enough to prevent turning from vibration.

Make sure Allen-head setscrew in knob is tight.

**CAUTION**

If knob does not turn easily, do not try to force it. If shaft binds, replace complete unit.

**INVERTERS.**—Check AN connectors on airplane's inverters to see that they are properly inserted and are tight.

Check main fuse contacts and wire connections to fuse clips on 400-cycle supply. Also check inverter fuse connections if the airplane is equipped with separate fuses for each inverter.

Check output voltage of each inverter by connecting an A.C. voltmeter to main "J" box terminals B10 and B1. Voltage should be 115 volts (plus 10 volts, minus 15 volts) when D.C. voltage is 28 volts. This tolerance covers the voltage limits for proper turbo control system operation.

Since the entire turbo control system receives its power from the inverts, careful maintenance of the inverts is necessary for dependable operation of the turbo control system.

Disconnect external power supply.

**MAIN "J" BOX.**—Check inside box for loose terminal connections, especially terminal B10, where



Col main power supply connects. To check terminals,  
27 grasp Sta-kon lugs as close to terminal as possible and jiggle sideways, using very slight pressure.

**CAUTION**

Do not pull on wires for this inspection, as this method would probably cause breakage rather than to prevent it.

Visually inspect wires in main "J" box for evidence of breaking at Sta-kon lugs.

Remove loose or foreign material from inside box.

In very moist, humid climates, check for corrosion around leads and terminals inside "J" box.

Check ground lead from main "J" box where it anchors to airplane, to see that it is firmly attached.

**AMPLIFIERS.**—Remove amplifiers from their case and press down on tubes to make sure they are not loose in their sockets.

Blow out any dust that has accumulated around tube sockets.

Visually inspect fuse contacts and all soldered connections.

Replace amplifiers in their cases and reconnect AN connectors.

Be sure each connector is properly inserted and tight.

Make sure Dzus fastener locks amplifier in its case.

Inspect Lord mounts under amplifier platforms. If rubber is badly cracked, replace the mounts.

**WIRING HARNESS.**—The wiring harness is regularly inspected every 50 hours. In very moist, humid climates, however, it may be necessary to inspect the harness more frequently. When operating under these conditions, also check the long cables inside the wing and inside the engine nacelles every 25 hours for corrosion and for accumulation of moisture inside the tape or Irvolute covering on cable. If wing and nacelle disconnects are used, they should be inspected for good contact.

**FLEXIBLE SHAFTS.**—In tropical areas or during very hot weather, disconnect the flexible drive from the governor every 25 hours, and inspect the flexible shaft for lubrication. If necessary, lubricate with light grease, Specification AN-G-3. In normal operation, the inspection of the flexible shaft is taken care of at the 100-hour inspection.

**EXHAUST MANIFOLD.**—Inspect exhaust manifold SPLICE CLAMPS. When cold, they should be loose enough to be rotated manually. Check for cracks in sheet metal parts.

**50-Hour Inspection**

**PRESSURETROL.**—Carefully inspect Lord

Col mounts. If rubber is badly cracked, replace  
27 mounts.

Remove cover plate and check potentiometer wiper to see that it is tight on its shaft. To do this, grasp wiper near clamp and twist counterclockwise until wiper reaches upper end of potentiometer winding. When released, wiper should return to its original position if it has not slipped. If wiper is loose, replace pressuretrol.

Note position of wiper on potentiometer winding. At sea level, wiper should be about one-fourth of the distance up from the bottom of the potentiometer winding. If wiper is above the center of the potentiometer winding, the pressuretrol may be out of calibration, or the reference bellows may be leaking.

**Note**

Where altitude of air base is above 5000 feet, normal position of wiper will be slightly above center of potentiometer winding.

Inspect red lacquer on calibration screws to see that they have not been tampered with. Calibration of the pressuretrol is fourth echelon work. Inspect all soldered connections.

Carefully inspect base of AN-connector pins inside pressuretrol for loose strands of wire.

Replace cover on pressuretrol.

**CAUTION**

**NEVER OIL ANY PART OF THIS UNIT**

**NACELLE "J" BOX.**—Check terminals for loose connections. To check terminals, grasp Sta-kon lugs as close to terminal as possible and jiggle sideways, using very slight pressure.

**CAUTION**

Do not pull on wires for this inspection, as this method would probably cause breakage rather than prevent it.

Inspect wires to see that they are not broken at Sta-kon lugs.

Check mounting of condenser and transformer.

Examine condensers for oil leakage. If there is evidence of leakage, replace the condensers.

Check to see that lock washers are on all terminals.

Remove any loose or foreign material from inside box.

Visually inspect soldered connections on the two 50,000-ohm resistors and on condensers.

Check Dzus fasteners to see that cover is held securely.



Col 27 In very moist, humid climates, check transformers for deterioration of insulation and for corrosion around leads and terminals inside "J" boxes.

**WIRING HARNESS.**—Check wiring harness inside fuselage at all points where wear or abrasion might occur. Also check harness inside engine nacelle from nacelle "J" box to each unit.

**INTAKE AND EXHAUST SYSTEMS.**—Inspect the INTAKE AND EXHAUST SYSTEMS for damaged MANIFOLDS, loose STACKS and RETAINING LUGS, broken or loose STUDS and BOLTS, and blown GASKETS. Lightly tap the exhaust stacks to loosen any scale formation, or brush out with a wire brush.

**TURBOSUPERCHARGER LUBRICATION.**—Draw off a small amount of oil from the turbosupercharger oil supply tank and inspect for dirt or sediment. If the oil contains sediment which will damage high-speed bearings, drain, flush, and refill with clean oil. If the oil remains clean, it may be continued in use indefinitely, or until necessary to change the grade of oil.

#### 100-Hour Inspection

##### Note

While the following is prescribed for 100-hour inspection periods for the turbosuperchargers and the turbosupercharger regulator system, it is desirable that it be performed at more frequent intervals. Performance of more frequent inspections is dependent on availability of necessary inspections equipment.

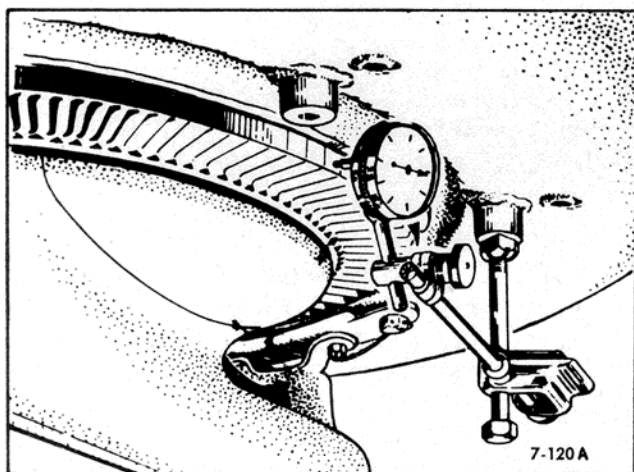


Figure 470—Checking Rotor Side Play

**TURBOSUPERCHARGERS.**—Check the total side play (radial play) of turbosupercharger rotor. Mount an indicator so that the pointer rests against the outside of the rim of the bucket wheel. Move the bucket wheel from side to side to check the total side play of the rotor for bearing wear. If the total side play is greater than .003 inch,

Col 27 the turbosupercharger must be replaced. Check the total end play (axial play) of turbosupercharger rotor. Relocate the indicator so that the pointer of the indicator rests against the edge of one of the buckets. Move the bucket wheel up and down to check the total end play of the rotor for bearing wear. If the total end play is greater than .009 inch, the turbosupercharger must be replaced.

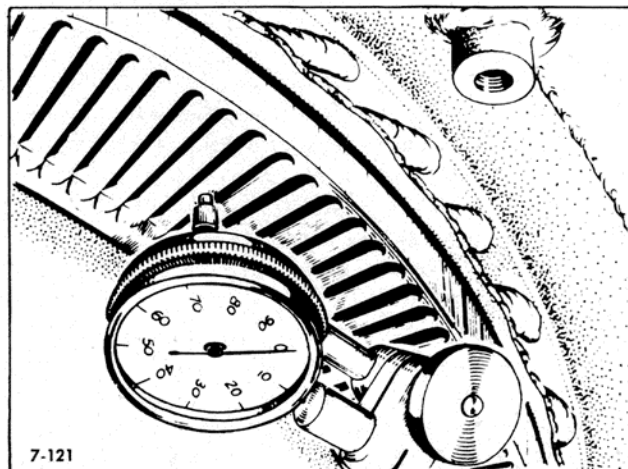


Figure 471—Checking Rotor End Play

**EXHAUST SYSTEM.**—Inspect the spring loaded ball and socket tail pipe joints to insure correct installation as shown below.

Inspect the springs, Solar part No. 1-877; replace if the free length is less than 4-5/8 inches.

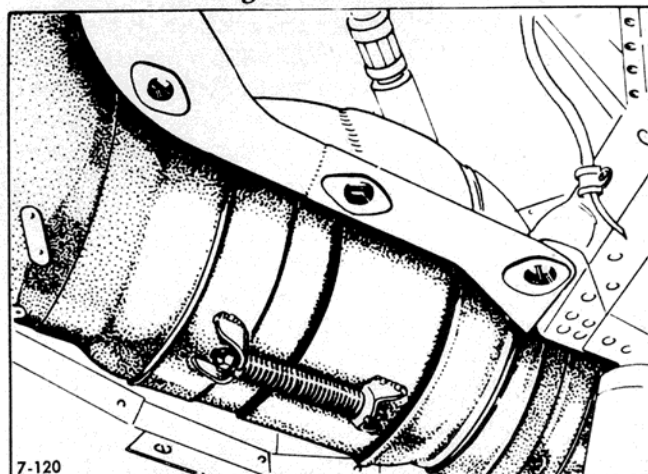


Figure 472—Correct Installation—Ball and Socket Joint

#### REGULATOR SYSTEM.

**FLEXIBLE DRIVE.**—Disconnect flexible drive at governor end, pull out the flexible shaft, and inspect shaft for wear. Lubricate if necessary (Grease Specification AN-G-3a). If flexible drive is worn at some point, replace the complete drive.

Replace flexible shaft. After sliding it into the housing, press it inward and turn until it slips into



Col place, engaging the drive connection on the turbo-  
27 supercharger.

Reconnect flexible drive to governor, being very careful not to cross-thread the nut.

**GOVERNOR.**—Disconnect AN connector from the turbo governor.

Remove the two screws which hold the cup-shaped cover on the accelerometer end of the governor. Remove the cover, being careful not to get dirt into the unit.

While someone spins the turbine wheel, watch the nut directly above the bearing plate, inside the governor, to see that it turns with the turbine wheel. (There is a reduction gear ratio between the turbine speed and turbo governor speed.)

#### CAUTION

Do not press on wipers of accelerometer potentiometer, as this may change their contact tension.

With the blade of a thin screw driver, carefully slide wiper away from dead-spot end of potentiometer winding in accelerometer; then release the wiper, allowing it to return under the pull of its own spring. This check will insure that the wiper moves freely.

#### CAUTION

This unit is never oiled except in fourth echelon maintenance.

Visually inspect flexible lead and soldered connections.

**NACELLE "J" BOX.**—Check output voltages of transformer. To do this, connect an external powers source to airplane, turn on inverter, and adjust D.C. voltage input to give 115 volts inverter output.

Voltage from transformer secondaries should then be as follows:

Terminals	Voltage
B7 to B9.....	30 volts (2.5, -1.5)
B5 to B3.....	24 volts (2.5, -1.5)
B3 to A2.....	6 volts ( .4, - .4)
A2 to B2.....	12 volts ( .7, - .7)

**TO CHECK ACCELEROMETER CONTROL.**—The accelerometer control should be checked during the first flight following the 100-hour inspection. At some altitude above 6,000 feet, retard the throttles individually to half-closed position, and then advance throttles rapidly to full-open position. The manifold pressure should not overshoot more than two inches unless RPM overshoots also. If engine RPM overshoots, repeat this procedure several times until propeller governor holds engine speed relatively constant.

#### 300-Hour Inspection

**AMPLIFIER.**—Replace the two 7C5 tubes in the amplifier after approximately 300 hours operation.

Col **TO CHECK OVERSPEED CONTROL.**—Imme-  
28 diately following a complete installation of the type B control system for turbosuperchargers and at approximately 300-hour intervals thereafter, the airplane should be flown to an altitude of 35,000 feet.

#### Note

If the carburetor intake duct is leaking, the overspeed will cut in at a much lower altitude. A serious leak in the exhaust stack may be misconstrued as overspeed control operation, as it will also cause a falling off in manifold pressure before an altitude of 35,000 feet is reached.

At 35,000 feet, level off and set propeller governors for maximum cruise RPM. Slowly turn dial of turbo boost selector toward "8." At some point before "8" is reached, the manifold pressure should stop increasing on all engines, indicating that the overspeed controls are cutting in. If the manifold pressure continues to increase on one or more engines, keep turning the dial clockwise, but do not exceed the maximum cruise manifold pressure. At 35,000 feet altitude, if the governor is set for the proper turbine speed the overspeed control should operate before maximum cruise manifold pressure is reached. When checking one of the engines at full throttle, the throttles may be retarded on the other engines.

#### Note

The overspeed control on the inboard engines will usually cut in at approximately two to four inches lower manifold pressure than the pressure at which the outboard engine superchargers reach overspeed. This is caused by pressure losses in the longer exhaust ducts and carburetor intake ducts.

Recheck the overspeed by lowering dial setting into control range, and again slowly increase dial setting until manifold pressures cease to increase.

#### 500-Hour Inspection

Every 500 hours, or at time of engine overhaul, replace the following turbo control units with new or rebuilt units:

- Waste gate motors
- Governors
- Pressuretrols
- Amplifiers
- Turbo boost selector
- Flexible drives.

Col  
28

#### PROPELLERS AND ACCESSORIES

##### 50-Hour Inspection

Using a magnifying glass, carefully examine the exterior of all parts of the propellers for cracks, nicks, bends, and similar defects. When the condi-



Col 28 tion of the blade warrants, local etching will be performed, following the procedure given in Section IV, paragraph 6. d.

Check for deterioration of markings on both the blades and the hub.

Check the entire installation for security of mounting, proper safetying, and for proper operation.

Check propeller governor for security of mounting. Check governor controls for security and condition. Inspect governor drive shaft and adapter for excessive wear and for proper safetying of exposed nuts, clevis pins, etc. Check governor assembly for free movement of drive.

#### 100-Hour Inspection

Check the propeller retaining nuts for looseness. If repeated tightening of the propeller hub retaining nut is necessary to maintain the proper tightness, the propeller will be removed and the cause ascertained.

Tighten if necessary, using the tubular wrench together with the composite wrench and a bar about three feet long. Apply a force of approximately 180 pounds at the end of the bar. While this force is being maintained rap the bar close to the wrench, with a hammer weighing about 2 1/2 pounds.

#### CAUTION

Do not tighten excessively.

Install the locking ring with the pin through the retaining nut slot, propeller shaft hole, and into the valve housing slot. Snap the wire into position in the groove provided for it in the retaining nut. Check to see whether or not the propellers are due for overhaul or disassembly. Maximum operating time—1750 hours.

Col 29

#### POWER PLANT—GENERAL

##### 25-Hour Inspection

With the engine ring cowls left on, make a rigid inspection of each entire engine and mountings. Check engine ring cowl supports and engine mounting lugs for tightness of bolts and condition of rubber bushings.

Inspect bolts and holes at cowl flap mounting ring splices for signs of vibrational wear.

Propeller shaft thrust bearing nuts will be checked for tightness. Subsequent tightening will be accomplished at the discretion of the engineering officer in charge, or at any time that the nuts are found to be loose. Wrench No. 40J3909 together with adapter assembly No. 40J3909-8 will be used for this operation.

The torque required by the use of this wrench is 600 pound-feet and is obtained by the use of wrench handle assembly No. 40J3909-40 (which includes —35 handle, —36 link, —37 hook, —38

Col 29 plate, and —39 weights), in conjunction with —32 clamp and the necessary adapter assembly. To accomplish this work it will be necessary to partially remove the propeller assembly.

Care will be taken to insure that nuts are not tightened excessively by the use of an extension on the wrench handle or by hammering on the handle.

##### 50-Hour Inspection

Remove all engine section cowl, including engine ring cowl, and open all inspection doors.

Inspect baffles for cracks, loose rivets, and security of mounting. Check condition and security of the engine dynamic suspension fittings.

Inspect engine cylinders for general condition. Check tightness of cylinder studs and hold-down nuts.

#### CAUTION

Do not tighten cylinder hold-down stud nuts and cap screws excessively. 3/8-inch studs—250 pound-inches minimum, 275 pound-inches desired, and 300 pound-inches maximum. 7/16-inch studs—350 pound-inches minimum, 375 pound-inches desired, and 400 pound-inches maximum.) Use torque indicating wrench No. 79-428450.

Check the compression on each cylinder. This should be done before the engine has thoroughly cooled after running. The compression should be checked at the first 50-hour inspection following engine installation at each 100-hour inspection thereafter.

Ascertain that push rod cover tubes are tight and that packing nuts are properly safetied. Push rod cover packing nuts should be snug but not excessively tight.

Check all clamps, bondings, rods, and the taping and safetying of all lines within the engine section of nacelle.

Inspect engine mounts for cracks (particularly at welds). Check the tightness of mounting and the security of engine to mount, and mount to nacelle. Check condition of protective coatings.

Lubricate starter hand crank extension support bearings with oil, Specification No. AN-VV-O-446.

##### 100-Hour Inspection

Check to see if engines are due for overhaul.

Inspect cylinders for general condition.

Check tightness of rocker box cover stud nuts. Avoid excessive tightness.

Inspect crankcase breather outlets for obstruction at first 200-hour inspection after installation.



**Col Engine Change Inspection**

- 29 Remove and magnaflux test all dynafocal suspensions. Replace all units found to be defective.

Lightly coat the interior of fittings, metal spacers, and washers with castor oil, Specification No. AN-JJJ-O-316, prior to assembly of rubber grommets in the mount. To tighten the 3/8-inch bearing bolts in the shackles and engine mount ring, apply a torque of 225 to 250 pound-inches. To tighten the 5/16-inch mounting bolt through the rubber vibration absorbers, apply a torque of 160 to 175 pound-inches. The 7/16-inch bracket bolts through the shackles and engine bosses are tightened to a torque of 350 to 375 pound-inches.

The four 5/8-inch steel bolts which attach the engine mount to the nacelle should be tightened to a torque of 900 to 1000 pound-inches.

When replacement pumps are available, all pump units, except those with less than 100 hours of service since last overhaul, will be replaced. This includes electric motor-driven pumps, fuels, vacuum and similar power-driven units.

Perform ground and flight tests as outline in Section IV, paragraph 6. a.

At every fourth engine change (or at any change made necessary by an internal failure of such an extent that metal particles are liberated into the oil system) the hopper type oil tanks should be removed and cleaned and the oil system thoroughly cleaned.

**Col COCKPITS AND CABINS****31 25-Hour Inspection**

Inspect seats (including supports and brackets) for security of attachment, condition, and functioning of adjusting mechanism. Check for breaks or

- Col** cracks in the seats which could foul parachute or  
**31** clothing. Oil seat adjustments.

Inspect windshields, windows, gun turrets, and doors for condition of frame and security of attachment. Check for cracks in glass or transparent sheet, condition and operation of sliding window and door mechanism. Inspect for cleanliness of all windshields and windows.

Inspect defrosters for condition, and check operation of ventilators and hot air controls. Inspect hot air tubes for leaks.

Inspect emergency exits for condition and proper operation.

Inspect all safety belts for cuts and fraying. Inspect latching devices, fittings, and attachment parts for condition and security.

**Semi-annual Inspection**

All safety belts except type B-11 will be removed and weight tested semi-annually, January 1st and July 1st of each year. Type B-11 safety belts will be removed and weight tested annually, January 1st of each year.

**Col FLIGHT CONTROL MECHANISM****32 25-Hour Inspection**

On airplanes operating from extremely dusty landing fields or through dusty (desert) areas, control cables will be thoroughly cleaned where they pass over pulleys, through fairleads, and at other points of contact throughout the airplane, and will not be coated with lubricant or rust preventive compound.

In coastal or insular areas where conditions are conducive to corrosion, clean cables at points of contact and coat with rust preventive compound, Specification AN-C-52.

**RUDDER CONTROLS.**

Inspect rudder pedal assemblies for proper condition and functioning of all parts.

Test functioning of pilots' pedal adjusting mechanism. Inspect for bent connecting rods or levers, proper safeying of all attachments and freedom from interference between rudder and elevators in extreme positions.

With pedals in neutral position, see that rudder is in the neutral position.

If lost motion exists, or if full motion of the rudder cannot be obtained without binding, rigidly inspect the entire system to locate and correct the troubles.

All accessible parts will be wiped clean.

**ELEVATOR AND AILERON CONTROLS.**

Inspect control columns, torque tubes, arm assemblies, and connecting rods for proper condi-

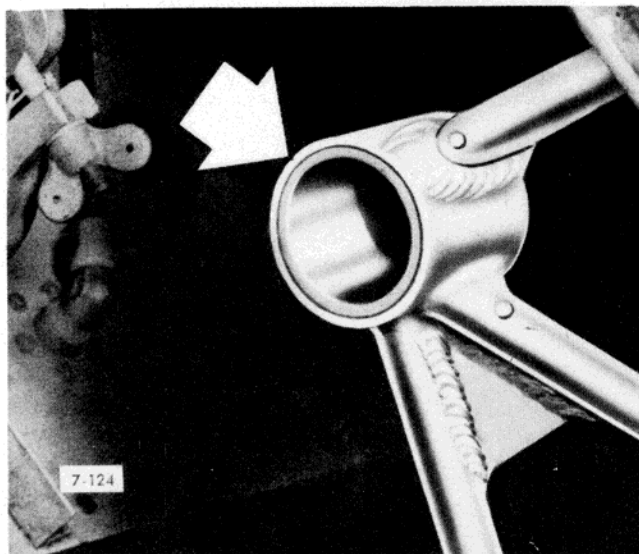


Figure 473—Hand Crank Receptacle—Starter

Col 32 tion and functioning of all parts. Check for security of control columns, for condition of rods and links, and for proper safetying of all attachments.

If lost motion or binding is present, or if full movement of ailerons and elevators cannot be secured without binding, rigidly inspect the entire system to locate and correct the trouble.

All accessible parts will be wiped clean.

#### FLIGHT CONTROL LINKAGE.

Inspect all turnbuckles, pulleys, guides, fair-leads, links, brackets and fittings for proper attachment and safetying.

Check for bent rods and links. Check fair-leads for condition and proper alignment and for elongated holes. Note particularly that cables, levers, and links are not chafing structural members.

Check cables for proper tension.

Control cables that are found to be frayed (individual wires broken) will be considered serviceable unless there are more than six broken wires in any one-inch length of the cable. The number of broken wires will be carefully noted, particularly where the cables pass over pulleys or guides.

All accessible parts will be wiped clean.

Remove all oil or grease from engaging portions of control surface locks.

#### TRIM TAB CONTROLS AND LINKAGE.

### WARNING

The relative motion of the trim tabs, due to "play" in their control systems, must not exceed 3/16 (.187) of an inch for the rudder and the elevator tabs and 5/32 (.156) of an inch for the aileron tab.

Inspect for condition and functioning of all parts. See that the tab indicators show correctly the position of trim tabs.

Inspect for signs of interference with other parts or assemblies, noting particularly that shafts to the trim tab castings are operating freely through openings provided in the surface.

Inspect for security and proper safetying of turnbuckles, rods, and attachment parts. Note general condition of cables and fair-leads. Determine tension of cables.

If lost motion exists, or if full motion of the trim tabs cannot be secured without binding, rigidly inspect the entire system to locate and correct the trouble.

Col 32 All accessible parts, except cables and fair-leads, will be wiped clean.

#### WING FLAP CONTROL MECHANISM.

Inspect for proper condition and functioning of all parts, and for security and proper safetying of all rods, joints, levers, and attachments.

Test functioning of control mechanism by operating it both electrically and manually.

See that position indicators in the cockpit indicate correctly the position of the flaps.

If lost motion exists, or if full motion of the flaps cannot be secured without binding, rigidly inspect the entire system to locate and correct the trouble.

#### LUBRICATION.

Lubricate rudder pedal and control mechanisms in accordance with the lubrication chart.

#### AUTOPILOT.

Inspect condition, security of attachment, and proper operation of the autopilot according to the instructions given in Section IV, paragraph 7. b. (7).

#### 200-Hour Inspection

See Column 22 for 200-hour inspection of wing flap operating motor.

Col 33

#### MOVABLE SURFACES

##### 25-Hour Inspection

Inspect rudder, elevators, ailerons, tabs and flaps for free and full movement, warping, broken ribs, or ribs loose at spars. Inspect condition of covering. Check for loose rivets and tears around rivets.

Inspect horns on castings and hinges for bends and breaks, security of attachment, worn or loose hinge pins, and for proper safetying.

Col 34

#### FIXED SURFACES

In case of damage to fixed surfaces, refer to the "Handbook of Structural Repair Instructions for the B-17G Airplane," T.O. No. 01-20E-3.

##### 25-Hour Inspection

Inspect surfaces for cracks, loose rivets, loose screws, corrosion, and general condition.

##### 50-Hour Inspection

Inspect wings for torn or loose covering, loose rivets pulling through metal covering, broken ribs, and open grommet drains.

Check screws in wing fuel tank access doors for general condition and proper installation.

Inspect wing joint at fuselage, wing terminals, attachment plates and flanges for security, cracks, and elongated bolt holes.



Col 34 Inspect horizontal and vertical stabilizers for torn or loose covering, loose rivets, rivets pulling through metal covering, and for broken ribs as indicated by distortion of metal covering.

Inspect all taper pins and tighten if necessary.

### Special Inspection

If for any reason the fairings from wing to fuselage are removed, the exposed surface will be inspected and cleaned.

## Col 35 FUEL TANKS

### 25-Hour Inspection

Inspect all fuel tanks for evidence of leaks, and deterioration.

Check safetying of release catches for bomb bay tanks.

Inspect drain nipples for security of attachment in leakproof tanks.

Check general condition of gaskets on fuel tank access doors.

### CAUTION

The fuel tank access doors are primary structural members and care must be taken that they are removed and reinstalled properly. A jacking cone is provided on the lower left engine mount connection in each nacelle. Jacking at these points is required in order to relieve torsional stresses in the wing while removing or replacing the wing fuel tank doors. For any use of the nacelle jacks, the body should be securely jacked to avoid the possibility of body weight settling on the jacked nacelles. If wing tank doors are to be removed from one wing only, a minimum of four jacks should be used; one to support the outboard engine nacelle on the wing concerned, one on either side of the body at body station 7. *Do not use jacking cones on the wheel axles for this purpose.* It is recommended that the nacelle jacks be left in place while the panels are off. However, if it is necessary to move the airplane with panels removed, no damage will result if it is towed slowly on a smooth surface.

Inspect the release mechanism of the releasable bomb bay tanks for condition and proper functioning and for alignment of pulleys, cables, and

Col 35 other moving parts of the mechanism. Check operation of both the normal and emergency bomb controls. Check safetying of release catches.

Inspect the releasable bomb bay tanks for cleanliness inside and out. Inspect for evidence of leakage, for condition and security of mounting brackets, and for evidence of undue wear at supports.

Inspect leakproof lining for cracks, soft spots, loose fragments, or any indication of deterioration.

Examine samples of gasoline taken from each fuel tank drain for evidence of lining fragments, sediment, or discoloration of gasoline.

When the releasable tanks are not installed, the lines will be covered or plugged to prevent the entrance of foreign matter. Plugs, when used, should be sufficiently large to prevent installation of the tanks without removal of the plugs.

Inspect the connections of the removable wing fuel tanks.

### 100-Hour Inspection

Drain the fuel tanks completely with the fuel drains located at the discharge port of the booster pumps.

Inspect fuel gage float for evidence of cracks or leakage.

### WARNING

When removing transmitters, be sure that the airplane's power is "OFF" as the transmitters are internally grounded.

Clean interior of fuel compartments, noting particularly that small holes in strainers are unobstructed.

Resafety all drains.

### 200-Hour Inspection

At 30 day intervals, or in connection with regular 200 hour inspections, whichever is first, the following inspection will be made on all self-sealing fuel and oil tanks. Completely drain the tanks, supporting the drain fitting by means of a crescent wrench to prevent excessive twisting when tank drains are opened and closed. Prior to placing the airplane back in service, refill the tanks and compare the quantity of fuel or oil required to fill each tank to the level of the filler neck with original capacity of the cell as reported on the filler cap. If the capacity of the tank is less than 95 percent of the quantity stated on the tank filler cap, open the cells and inspect to determine the cause of the reduced capacity.

Col 35 This inspection can be conveniently made by conducting it at the conclusion of a mission and before the tanks are again filled.

Inspect and clean the fuel gage rheostats mounted on the fuel tanks.

Check the float position for accurate indication on instrument panel.

#### Semi-annual Inspection

(This inspection applies to both fuel and oil tanks.) At the end of each six months of service, thoroughly inspect the interior of all self-sealing tanks for any indication of failure. This will be accomplished through inspection openings, or, if necessary, by the removal of the tanks from the airplane. If evidence of deterioration is found, each cell so affected will be repaired or replaced. The cells in which no evidence of deterioration is found will be reinstalled in the airplane.

Col 36

#### TAIL WHEEL GEAR

##### Note

All tail wheel gear lubricating fittings should be serviced immediately after each exposure to salt water to force moisture from the joints and prevent corrosion.

#### 25-Hour Inspection

Inspect the entire tail-gear assembly and retracting mechanism for cracks, breaks or bends, particularly at sharp angles and welds.

Inspect shock strut for leaks. See Preflight Inspection in this section for instructions on servicing the shock struts.

Inspect attaching bolts and nuts for tightness and for proper safetying.

Check for proper operation of swivel mechanism.

The tail wheel retracting assembly will be thoroughly inspected for wear. Replace any retracting screw and nut showing thread wear before further flight.

Check shear bolt for signs of wear and replace if necessary.

Check for proper operation of tail gear centering lock. Locking plunger should "bottom" in the slot when tail gear is in trailing position.

#### 50-Hour Inspection

At the time of the landing gear inspection, with the airplane supported free from the ground, test the functioning of the retracting and lowering mechanism by operating with both the electric motor and the emergency hand crank. See that the position indicator in the cockpit is synchronized with the tail gear.

Col 36

#### IMPORTANT

The Eclipse and General Electric type retracting motors require opposite directions of hand-cranking. Eclipse motors hand-crank counterclockwise and General Electric motors handcrank clockwise to lower the landing gear or tail gear. Make sure that the decal which indicates "DOWN" or "UP" direction of handcranking for the landing gear and the tail gear is correct.

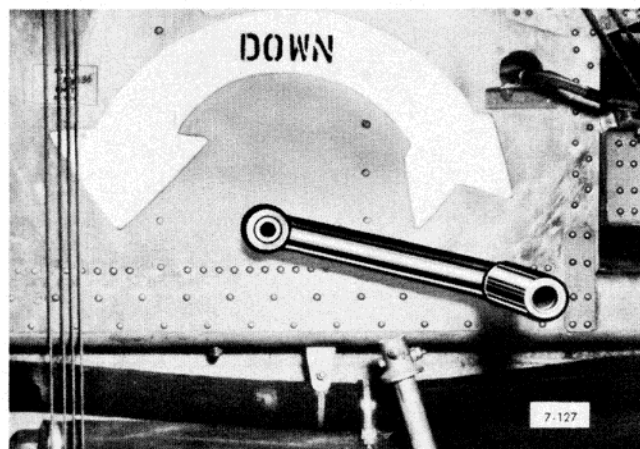


Figure 474—Hand Crank Decal—Main Landing Gear

#### WARNING

In order to prevent injury to personnel, never operate the retracting mechanisms with the handcrank unless the landing gear switch is in the "OFF" position.

#### 100-Hour Inspection

Grease the tail gear retracting screw. See lubrication chart.

#### 200-Hour Inspection

Remove the tail wheel and disassemble. Thoroughly clean all parts. Inspect roller bearings and relubricate, working the grease into the roller bearings. Do not grease excessively. Do not apply lubricant in the center hub between bearings. Refer to lubrication chart, for correct lubricants. See that felt retaining washers are in good condition. Reassemble casing and tube after inspection for damage. Reinstall and adjust to a point that all appreciable axial end play is eliminated, but make sure that wheel revolves freely and is true after operation is performed.

See Column 22 for 200-Hour Inspection on retracting motors and limit switches.

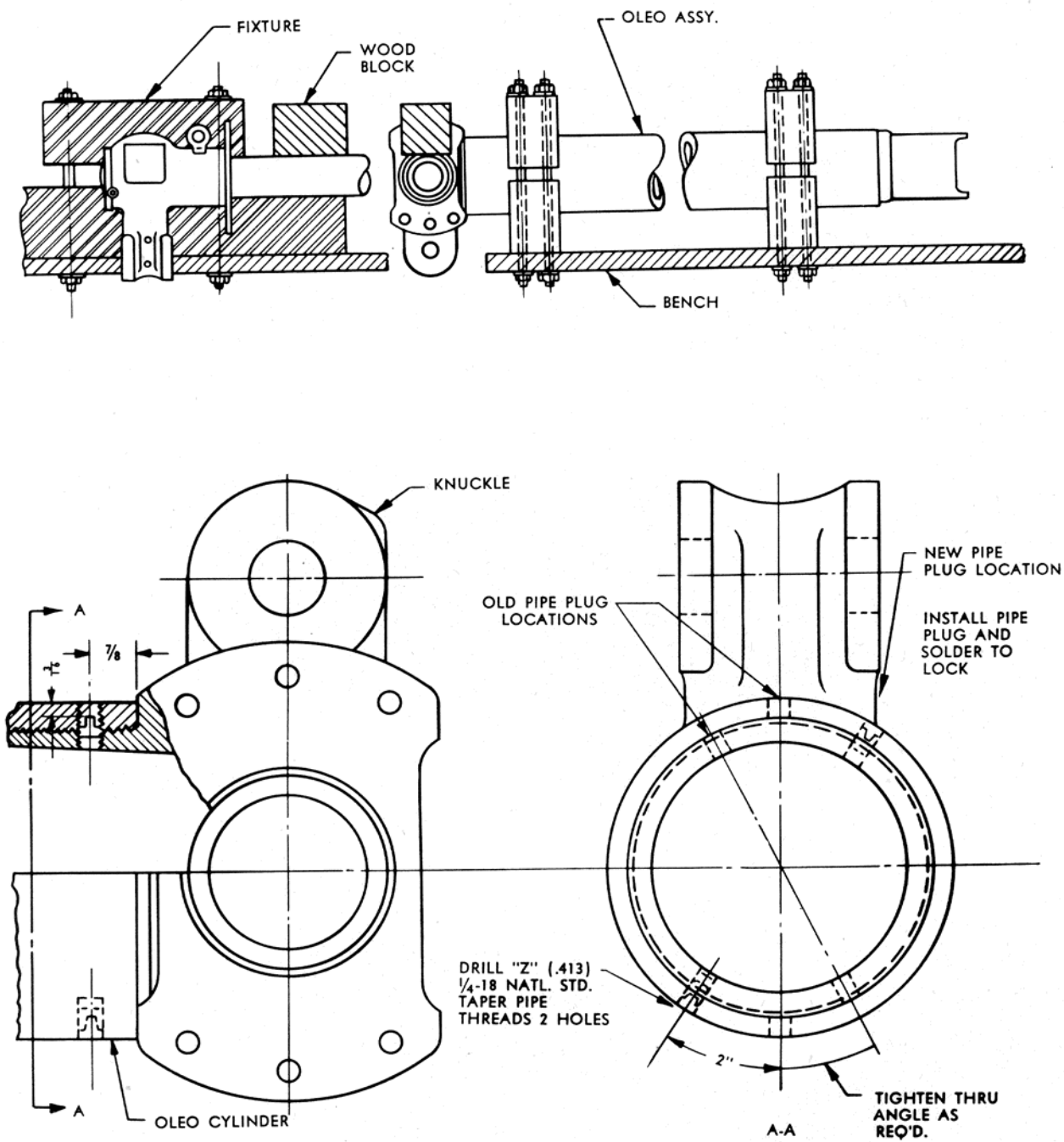
#### MAIN LANDING GEAR

##### Note

All landing gear lubricating fittings should be serviced immediately after

Col 37





7-128

Figure 475—Elimination of End Play between Shock Strut Cylinder and Knuckle

Col  
37 each exposure to salt water to force moisture from the points to prevent corrosion.

#### 25-Hour Inspection

Inspect entire landing gear installation and retracting mechanism for cracks, bends, security, and condition of attachment fittings, elongated bolt holes, and for loose, missing, or unsafetied bolts, nuts, and cotter pins. Inspect shock absorber struts for proper air pressure. See Preflight Inspection in this section for instructions. Check for oil leakage.

Lubricate in accordance with the lubrication chart.

#### 50-Hour Inspection

With airplane on jacks, check the electrical operation of the landing gear. Check for freedom from erratic or too noisy operation. A slight chatter during power operation is normal. Check track and mesh of gear sector and worm. Check cleanliness of retracting screw mechanism. Check main landing gear operation by using the emergency hand crank.

Lubricate in accordance with the lubrication chart. Examine the shock strut cylinders to detect possible scoring by the bolts which attach the lower collar to the main landing gear strut. Should this be the case, the collar must be replaced.

#### IMPORTANT

Clearance between collar and strut must be at least .011 inch on the diameter.

Check for end play between the shock strut cylinder, part No. 3-9164, and knuckle, part No. 15-6181, with the wheels on the ground. If a feeler gage shows any clearance at the inboard side of the shock strut cylinder, by this check, then jack the airplane, but do not use any jacks or supports under the landing gear. With a feeler gage measure the clearance between the end of the shock strut cylinder, part No. 3-9164, and the knuckle, part No. 15-6181. If a play of .008 inch or over is found, rework the assembly as follows:

#### WARNING

This repair may be made **ONCE ONLY**. More than four plug holes will give an excessive reduction in the strength of the strut.

Remove strut assembly from landing gear.

Construct two assemblies as shown in figure 472.

Mount fixtures and insert strut as shown. Secure strut from turning, by tightening nuts.

Col  
37 Remove solder from present pipe plug holes.

#### CAUTION

The solder is soft and can be picked out with a knife. Do not use heat as it may distort the polished strut surface. Remove the two pipe plugs with Allen wrenches.

Place a block of wood on the axle and screw knuckle into oleo cylinder by repeated blows on the wood.

Drill and tap two new holes for the pipe plugs.

Solder over plugs, keeping solder level within the hole.

#### 200-Hour Inspection

See Column 22 for 200-Hour Inspection on retracting motors and limit switches.

Col  
38

#### WHEELS AND BRAKES

##### 25-Hour Inspection

With parking brake set, inspect entire brake system from reservoir to wheel cylinders for leaks, condition of attaching clips, and flexible connections. Inspect brakes for entrapped air (soft spongy feel to brake action) and for leakage at brake cylinder sleeve. Check clearance between brake lining and brake drum. Brakes should hold airplane at full throttle. For information on bleeding the hydraulic system, see section IV, paragraph 7. c., in this Handbook.

#### CAUTION

Do not apply the brakes with wheels removed.

The hydraulic brake metering valves at the pedals are not adjustable but small movements of the pedals toward the "ON" position may be provided by the adjustment screws on the pedal mechanism. No adjustment is provided for the position or tilt of the pedal.

##### 50-Hour Inspection

Inspect all wheels for evidence of corrosion on visible portion of rims. Clean and paint if necessary.

Inspect for evidence of excessive wear between wheel bushings and axle, for excessive play, and for interference between wheel and backing plate. Remove tires and inspect the casings, tubes, and wheel rims as follows:

**CASINGS.** Inspect inside of carcass, beads, sidewalls (both inside and out), and tread for ruptures, breaks, cuts, blisters, or any other serious damage.



Col If tread cuts are present that do not penetrate the  
38 fabric, the cuts should be cleaned and filled with tire cut filler, cemented in place. (Tire cut filler cement will be procured locally as required.) If sidewall blisters can be cleaned without damage to fabric carcass, or if rubber fairing above rim flange is separated from fabric without damage to carcass, they should be cleaned and repaired with rubber airship cement, Specification No. AN-C-54 (Class 04-B).

Tires that have struck damaging objects, or that have been subjected to abnormal usage, should be removed and inspected for damage whenever it is deemed necessary by the engineering officer.

**TUBES.**—Examine valve for damage or faulty connection to tube. Inspect tube for wrinkles, creases, thin spots, cuts, or any type damage.

If any damage is found, tube should be repaired if possible; otherwise it should be replaced. Tubes having extra thickness at point of contact with wheel rim need not be replaced if wrinkles occur at this point, providing no damage is found due to chafing.

**WHEEL RIMS.**—Clean and examine rims for cracks, damage due to tire mounting tools, or impact with any object. Repaint rims if worn through.

To obtain maximum balance between the tire and tube assembly, the balance marker on the tube, which represents the heavy spot of the tube, must be mounted next to the red balance marker on the casing, which represents the light spot of the casing. Improper balance between tires and tubes will cause the landing gear to vibrate excessively during take-off.

Inspect brake drums for scoring, undue wear, loose screws, cracks, etc. Examine shoes for uneven wear, as indicated by unburnished spots on the shoes.

Inspect brake mechanism for distorted or cracked shoes or backing plates, loose rivets, and freedom from grease. Examine security and safetying of nuts or bolts and observe cracks, breaks, loose or worn parts, and excessive leakage.

Inspect parking brake control for general condition, security of attachment, and for proper safetying.

Col  
39

## HYDRAULIC SYSTEM

### 25-Hour Inspection

Rotate the handle on the hydraulic system filter several turns.

Check all units on the hydraulic panel for leakage. Inspect all hydraulic lines and connections for leaks, dents, cracks, security of anchorage, wear

Col due to chafing or vibration, etc. Inspect for de-  
39 terioration of flexible connections.

Inspect all hydraulic valves for general condition, proper operation, and evidence of leakage.

Check the electric motor-driven and hand-operated hydraulic pumps for condition and functioning and security of mounting.

Check pressure regulator for leakage.

Inspect the accumulator for indications of leakage. Check to see that accumulator will operate hydraulic system. To service the accumulator see Section III, paragraph 2. *b*.

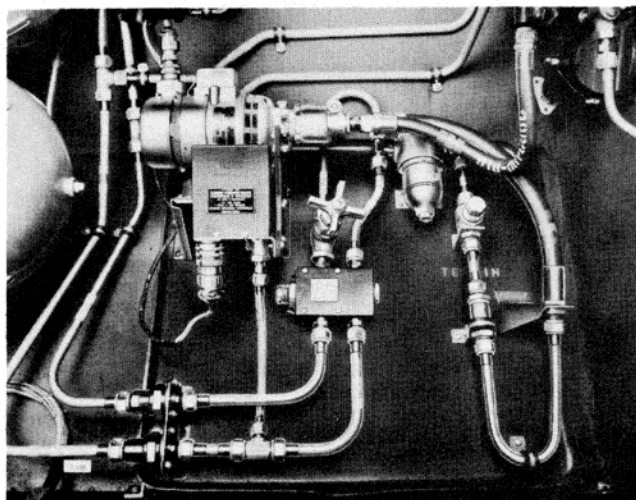


Figure 476—Hydraulic Panel Installed

### 50-Hour Inspection

At the time of the first 50-Hour Inspection after installation, all electric motor-driven hydraulic pumps should be removed and their rotating parts should be tested for freedom of movement by turning the drive coupling with the fingers. If the pump has been replaced between inspections, the new pump should be given this test at the 50-hour inspection falling nearest the time at which the pump has been in service for 50 hours.

In the event that excessive resistance to rotation of the moving parts of the engine-driven hydraulic pump is found, the pump should be replaced and the defective unit returned to the depot for overhaul.

### 100-Hour Inspection

See that all line connections to the hydraulic fluid pumps are tight and that all mounting nuts are drawn up tight and are properly safetyed.

Remove the plug from bottom of the hydraulic filter and drain all foreign matter. Replace and safety plug.

*Col* **800-Hour Inspection**

- 38 Replace all flexible hydraulic lines in the engine sections and those exposed to the weather (such as brake lines and the landing gear).

*Col* **1200-Hour Inspection**

- 39 Replace all flexible hydraulic lines that were not replaced at the 800-hour period.

*Col* **FUSELAGE**

- 40 Refer to the "Handbook of Structural Repair Instructions for the B-17G Airplane," T.O. No. 01-20E-3, for complete information concerning repair of damaged fuselage structure.

**25-Hour Inspection**

Inspect the interior and the exterior of the fuselage for condition of the skin. Wrinkles or distortion indicates a weakness of the structure. Inspect doors, escape hatches, and windows. Check for bent longerons, or braces, and loose bolts or pulled rivets. Check carefully for signs of structural failure, particularly around entrance doors. Check for evidence of corrosion.

**50-Hour Inspection**

Check security of mounting bolts attaching the plastic nose section to the fuselage, joint splice bolts at station 6, and the tail enclosure mounting bolts at station 11.

Inspect all accessible portions of the fuselage exterior and interior for bent structural members, breaks, cracks (particularly at sharp bends and at welds), and for loose members or rivets.

Inspect for proper attachment of inspection doors, covers, fairings, and cowlings. Check for leaks, condition of metal covering, and protective coatings, particularly when the airplane has been exposed to salt water.

*Col* **OXYGEN EQUIPMENT**

41

**DANGER**

Never use a mixture containing oil or grease or any connections, packings, valves, gages, or other oxygen equipment. Failure to observe these precautions will result in an explosion.

**25-Hour Inspection**

Inspect the oxygen cylinders, regulators, tubing, and flexible lines for security of mounting. Check the distribution and the supply systems for leaks, evidence of corrosion, dented or buckled tubing, and loose clamps or connections.

*Col* **AIRPLANE—GENERAL**

43

**25-Hour Inspection**

**Deicer Equipment**

Check deicer shoe attaching screws for tightness. Check feed lines in both wing and tail for security

*Col* and general condition.

- 43 Inspect and clean all screens in the vacuum system relief valves.

**Anti-Icing Equipment**

Inspect all lines leading from the anti-icer supply reservoir to propellers for condition and security of attachment.

Check the anti-icer slinger rings for security of mounting and conditions.

Remove and clean fluid filter if discharge is inadequate.

**Heating and Ventilating System**

Inspect heating and ventilating system for leaks and for condition of units, lines, and fittings.

Inspect for condition and operation of ventilators.

Inspect defroster tubes for leaks and for proper operation.

**50-Hour Inspection**

**CO<sub>2</sub> Cylinders**

Remove all CO<sub>2</sub> cylinders at the first 50-hour inspection period after initial installation or replacement, and check the weight of the cylinder charge. If no leakage is indicated, subsequent removals for inspection by weighing will be made at six-month intervals thereafter. Replace if necessary.

**LIFE RAFTS**

**CAUTION**

The CO<sub>2</sub> cylinder release cable must be disconnected from the life raft compartment door latch before pulling the handles in the radio compartment if it is desired to inspect the rafts without inflating them. Access from outside the airplane to the latch is provided through a removable door aft of the raft compartment.

Remove the life rafts from compartments and inspect for proper installation of CO<sub>2</sub> cylinders.

Check the cylinders for evidence of rupture of the safety indicator disc and check the handle for proper safetying.

Check weight of cylinders. If there is a loss of .03 pounds or more, fill or replace.

Check the valves on each gas cell to see that they are securely tightened.

Inspect for proper attachment of the cord and harness on the compartment door.

Inspect all exposed metal parts of the life rafts for corrosion. Replace parts found defective.



**Col Anti-Icer Equipment**

43 Check propeller, windshield, and carburetor anti-icer pumps for security of mounting, and absence of leakage along the tubing or at the connections.

See that all electric connections in the system are clean and securely fastened. Repair or replace any damaged connections or wires.

Remove the inspection plug from the top of the end shield at the drive end of the pump and note the condition of the commutator and brushes.

Inspect commutator for proper seating and presence of excess oil. Remove foreign matter with a clean cloth moistened with carbon tetrachloride. Avoid using sandpaper, if possible. If necessary, apply No. 0000 or finer sandpaper by folding a narrow strip over the end of a finger. Never use a screw driver or any other metal instrument and never use emery cloth.

On propeller anti-icer pump motors, remove the two screws holding each brush cover shield and unscrew the slotted brush cap screw to inspect brushes. Replace brushes if worn to a length of 11/32 inch. Clean the brushes with a rag moistened with carbon tetrachloride, or if brushes are coated with any substance that resists cleaning fluid, dress them carefully with a piece of fine sandpaper, taking care neither to sand excessively nor to destroy flatness.

Remove filter from the line near the pump and clean thoroughly.

**Heating System**

It is important that the filter in the glycol heating system be removed and cleaned every 50 hours of flying time to prevent total restriction of the flow to the heater units due to carbonization of the fluid and unsatisfactory operation of the system.

All glycol heater fittings in the leading edge and glycol radiator lines will be inspected for looseness. Remove lagging to leave fittings exposed.

Remove and clean the glycol heater cores as directed in Section IV, paragraph 7. f. (3).

**Deicer Equipment**

The ELECTRICAL CONDUCTIVITY of the outer surface of the deicer shoes will be checked by the use of an ohmmeter and a contact block. The contact block will be applied to all shoes at the middle and near each end. As the upper surfaces of the shoes are subject to rapid deterioration due to the effect of the sun's rays, particular attention will be given to these areas. If the ohmmeter indicates a resistance of more than 15,000 ohms, two coats of deicer conductive cement (Stock No. 6600-106400 or Stock No. 6600-

Col 106350) will be sprayed on the outer surface to increase the electrical conductivity. The ohmmeter, Weston model No. 697, supplied with C-1 instrument testing set, or any other suitable ohmmeter which may be on hand, will be used in connection with contact block.

**Aircraft Data Case**

At each 50-hour inspection, the publications in the aircraft data case will be checked against the Technical Order Index, T.O. No. 00-1, to determine if the latest issues are on hand.

**100-Hour Inspection****Vacuum System**

Check vacuum pumps for security of mounting.

Examine relief valve screen. If dirty, remove the screen assembly with a wrench, clean, and replace.

Remove and clean safety valve in the oil separator in the wing gap. If the valve disc is worn, dress it carefully with a flat oilstone. Test spring tension. The force must be at least 3.7 pounds.

**Heating System**

Flush out HEATING SYSTEM as instructed in section IV, paragraph 7. f. (3). Check pump and replace if necessary. Fill system with fresh fluid.

**Engine Change Inspection****Heating System**

Remove the glycol heaters from the exhaust stack and inspect them for evidence of general deterioration and wear. Make repairs and replacements if necessary.

**Semi-annual Inspection****CO<sub>2</sub> Fire Extinguishers**

(If Installed)

Remove cylinders and check CO<sub>2</sub> gas charge by weighing. If no loss charge is shown, the inspection date on the cylinder will be changed and the cylinder reinstalled.

Access to the cylinders for the engine section fire extinguisher is through two removable panels in the right side body compression strut. The three hand-operated CO<sub>2</sub> extinguishers, AAF type A-17, are located as follows: one on the right rear side of bulkhead 5, in the radio compartment; one on the right forward side of bulkhead 4, in the pilot's compartment; and one on the rear wall of the bombardier-navigator's compartment.

**Life Rafts**

Each life raft in use will be removed from its compartment and inflated. While inflated, carefully check for punctures, porous spots, and excessively

- Col chafed areas. All seams will be carefully inspected.
- 43 The cylinder connection, manifold, and valves will also be checked for leakage.

#### Hand-Operated Fire Extinguishers

Two hand-operated carbon tetrachloride fire extinguishers, AAF type A-2, are located as follows: one of the left side of the pilot's seat support and one on the forward side of bulkhead 7, just aft of the main entrance door.

Check each installed extinguisher every twelve months for proper pump action, if not used or re-filled during that period. If necessary to refill, fill only with fire extinguishing liquid, Federal Specification No. O-F-380.

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### NAVIGATION INSTRUMENTS

#### 25-Hour Inspection

Inspect the astro-compass for loose fit in leveling screws, excess play between face plate and horizontal circle, loose fit on sight bracket and cracked lens.

#### 50-Hour Inspection

Inspect all instruments, including the clock, for chipped luminous markings, security of mounting, and tightness of connections (including electrical connections where used).

Check marking of air-speed indicator. Mark if necessary, using a red line, indicating maximum permissible indicated air speed, and white reference marks on the cover glass and case.

Check rate of climb indicator installation for security of attachment of indicator and tank.

Inspect air-speed lines for security of mounting and tightness of connections. Drain if necessary. Check air-speed head for security of mounting and general condition. Clean holes in air-speed head with soft copper wire. Inspect heating units.

Check vacuum pressure and static lines for leaks, obstructions, and security of mounting.

Inspect drift meter or drift recorder for general condition, smooth operation, and security of mounting. Check the alignment and clean the external lenses if necessary.

Check instrument panels for defective vibration absorbers and support brackets. Replace if necessary.

Check bonding of panels, lines, and instruments. Connect one terminal of a suitable milliohm-meter to the part under test, and the other terminal to a structure of the airplane as near as possible to point of bonding. The resistance between the parts requiring bonding and structure should not exceed .004 ohm.

- Col In addition to a general inspection of the altimeter installation and tubing connections, a careful check of the zero setting adjustment shall be made, using a portable altimeter as follows:
- 44

Take the portable altimeter, part No. 37D3341, to the control tower and set pointers to read the surveyed elevation of the station altimeter above sea level. Vibrate the instrument before taking the reading. The pressure scale of the portable altimeter should read the existing "altimeter setting." If it does not, loosen the zero setting adjustment screw just to the left of the setting knob, and displace it to the left. Do not remove screw. Then, with the pointers still reading the elevation, pull out on the setting knob and turn it until the pressure scale does read the existing altimeter setting. Check this carefully and vibrate the instrument. Then push the knob in, move the screw back to the right, and tighten it. The portable altimeter now reads correctly for the existing altimeter setting, and the scale correction is "zero" for this pressure.

Carry the portable altimeter to the altimeter in the airplane, being sure to leave the pressure scale set to the existing altimeter setting. Set the reference markers on the airplane altimeter to "zero," read the pointer indication and determine the scale correction for this pressure altitude. Now vibrate and read the portable altimeter, and subtract the correction, which has just been determined for the airplane's altimeter, from this reading. Next set the pointers of the airplane altimeter to read this value, tapping the instrument sufficiently to remove all friction. The pressure scale of the airplane's altimeter should read the existing altimeter setting as set on the pressure scale of the portable altimeter.

If, after this procedure, the airplane's altimeter does not indicate the existing altimeter setting, loosen the adjusting screw to the left of the knob (do not remove the screw), and displace it to the left. Then pull out on the knob and turn it until the pressure scale does read the existing altimeter setting, keeping the pointers on the corrected reading determined in the preceding paragraph. Tap the altimeter during this procedure to remove the friction. If the pointers read properly, and the pressure scale reads the existing altimeter setting, move the screw back to the right and tighten. The airplane's altimeter is now set to the proper correction on its scale correction card, and all the other corrections appearing thereon should be applicable for other altitudes.

#### Note

Scale correction cards will not be prepared from data obtained during tests



Col 44 with open mercurial manometers, or so-called "master" altimeters. Correction cards will be prepared **ONLY** from data obtained during tests against standard mercurial barometers at Army Air Forces Depots or during original acceptance tests.

Check the gyro flux-gate compass indicators as outlined under Preflight Inspection. Inspect the transmitter, master indicator, amplifier and repeater indicator for security of mounting.

### 100-Hour Inspection

#### GENERAL.

The vacuum supply to vacuum-operated instruments will be checked at each instrument to insure correct functioning.

Remove bank and turn indicator. Remove drain plug at bottom of the instrument near front and drain accumulations of oil and water. Clean screen. Reinstall instrument and test vacuum. Vacuum should be 1.80 to 2.05 in. Hg with engine operating at normal cruising RPM.

Compensate compasses and record readings on form 57 at the end of each 100-hours of flying time, at each change of engines, guns, or electrical equipment likely to affect compasses, or at least once during each three month period.

The astro-compass should be placed in a test bench rig and all scales and rotation tolerances checked.

Check air-speed tube installation for voltage drop and for leaks. With the heating element of the air-speed tube properly connected and operating from the battery source of 24 volts, the voltage as measured at the tube shall not be less than 21 volts.

Remove drain plugs from lowest point in air-speed tubing and drain any water which may have collected in the line.

#### GYRO FLUX-GATE COMPASS.

Check the gyro flux gate compass indicators as outlined under Preflight Inspection, Navigation Instruments. Then with the engines running and the gyro uncaged, allowed 20 minutes more for the erection system to bring the gyro to vertical. If possible, the aircraft should be brought into a position simulating normal flight. Head the ship successively north, east, south and west. The pointer on the master indicator and repeater indicator must read within two degrees of each of the four headings. If the indicators do not read within the specified tolerance, check the applied voltage, which must be within .10 percent of the setting selected in the amplifier when the compass system was installed.

Col 44 If the trouble does not lie in the power supply, it will be necessary to recompensate in accordance with the procedure outlined in Section IV, paragraph 7. a. (26). Recompensation will be necessary because of a change in the magnetic characteristics of the aircraft itself due to changes, additions, or replacements in engines, electrical equipment, or armament, or possible to the effect of a long flight on one heading which may have caused a slight shift in the ship's magnetic field.

Should recompensation fail to bring the reading within the specified tolerance, the cause of error must be sought within the system itself.

### 500-Hour Inspection

Clean vacuum line air filter. (Under some service conditions this may have to be done more often.) Cut the lock wire and unscrew the end bolt of the filter. Remove the bowl. Remove the diffuser and filter element from the bowl and clean with compressed air, applying it first to the open ends of the tubular filter elements. Remaining dirt may be removed by applying air on the outside of the elements from either end.

#### CAUTION

Do not apply air at right angles to the tubes, as this will tend to wedge impurities between the filter discs.

Use a clean cloth to wipe off remaining dirt on filter elements, bowl, diffuser, and on the interior of the head, especially the outlet port, gaskets, and inlet screen.

Reassemble the diffuser and filter elements in bowl and install the bowl puller nut loosely by hand, locking it with a cotter pin. Reassemble the bowl to the filter head and lock wire the bolt.

### Annual Inspection

Every twelve months, the altimeter, together with its corresponding scale correction card, will be removed and forwarded to the depot for recalibration against a mercurial barometric standard barometer. A calibrated altimeter and correction card will be installed in its place.

Scale correction cards will not be prepared from data obtained during tests with open mercurial manometers, or so-called "master" altimeters. Correction cards will be prepared *only* from data obtained during tests against standard mercurial barometers at Army Air Forces Depots or during original acceptance tests.

Check the gyro flux gate compass as follows: At the end of each 500-hour period of operation, the transmitter, master indicator, and remote indicator should be removed from the airplane and forwarded to a properly equipped and recognized base for overhauling. Neither the transmitter or

Col master indicator may be disassembled at any place  
44 where dust or moisture can get into or fall on the bearings and working surfaces.

**Note**

In replacing the transmitter and master indicator, the units should be installed and the system recompensated in accordance with instructions outlined in Section IV, paragraph 7. a. (26).

Check the amplifier for security of mounting. Check the tubes in the amplifier and replace if necessary. Under normal conditions, tubes should not require replacement before the first 1000-hour period since they are operated at substantially below capacity.

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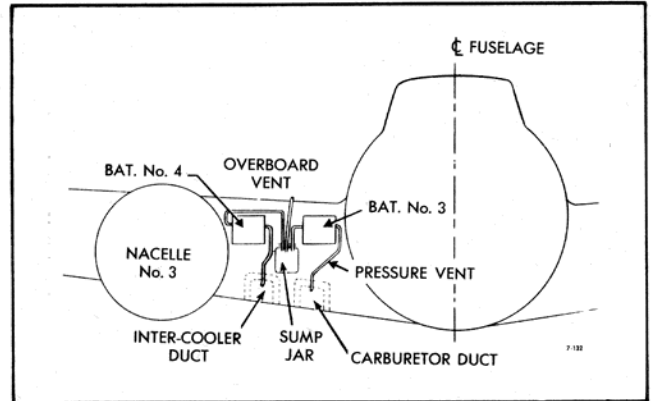
**BATTERY  
25-Hour Inspection**

Take hydrometer readings of all cells. If a difference of 25 points is found between any cells, remove battery for the purpose of adjusting electrolyte and testing for possible failure.

Inspect the battery leads for condition of insulation, and for security of attachment.

Inspect the terminals for security of connections and corrosion. If dirty or showing signs of corrosion, disconnect, scrape clean, and reconnect, and then apply vaseline lightly over metal surfaces (except terminals of shielded batteries not exposed to battery gases).

Inspect battery box (except shielded type in which the box is an integral part of the battery) for leakage of electrolyte and corrosion. In case of leakage, examine the airplane structure carefully for damage. Replace a leaking battery.



**Figure 477—Battery Installation—R. H. Wing**

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**CAUTION**

If battery electrolyte has been spilled on aluminum-alloy parts of the airplane, wash off immediately with a dilute solution of sodium bicarbonate (one tablespoon to one pint of water). Flush thoroughly with water when fizzing stops. If sodium bicarbonate is not available use soap and water.

Check battery vent system to insure that vent lines are unobstructed and securely anchored.

Remove cover on battery drain sump assemblies and if felt pads are covered with a white flaky deposit, remove them, wash in clear water, and saturate with sodium bicarbonate solution before replacing.

**50-Hour Inspection**

Paint sump body with acid-proof paint, if required.



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