AC 20-9

PERSONAL AIRCRAFT INSPECTION HANDBOOK

REVISED 1964

FEDERAL AVIATION AGENCY

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Flight Standards Service

For sale by the Superintendent of Documents, Government Printing Office
Washington, D.C., 20402 - Price 50 cents

PREFACE

The *Personal Aircraft Inspection Handbook* is intended primarily for use by student mechanics, pilots, and especially personal aircraft owners having a desire to become more familiar with their aircraft and related inspection techniques. It provides a general guide for inspection of aircraft but should be supplemented by information contained in pertinent Federal Aviation Agency publications and in the aircraft manufacturers' service instructions. Throughout this handbook an effort has been made to explain inspection in simple, nontechnical language.

Emphasis is placed upon the fact that reliable inspection comes only with experience and that the use of this handbook by the novice does not qualify him to make final determinations regarding the airworthiness of the aircraft. A qualified repair station or certificated mechanic, or the aircraft manufacturer, should always be consulted when doubt exists.

Part I of this handbook deals with the fundamentals of inspection; Part II covers typical inspection in detail. To facilitate reference to important inspection processes, use has been made of: (1) bullet symbols (•) in the text to call attention to items to which special consideration should be given, and (2) arrows appear on many of the illustrations to indicate either the item under discussion or the general area to which reference is made.

Selection of illustrative material for this handbook was governed solely by efforts to convey information to the reader in the clearest and most effective manner. Selection is not intended to show preference for any particular products.

Acknowledgment of cooperation is extended to the following:

Edo Corporation;
Cessna Aircraft Company;
Rohm and Hass Company;
Aircraft Radio Corporation;
Piper Aircraft Corporation;
National Aeronautical Corporation;
Mitchell Industries, Incorporated;
Aero Commander, Incorporated;
and Fluidyne Engineering Corporation.

Appreciation is also extended to those fixed-base operators whose cooperation made procurement of the photographs possible.

This publication supersedes the *Personal Aircraft Inspection Manual* issued in November 1950 as Civil Aeronautics Administration Technical Manual No. 101.

This handbook was prepared by the Federal Aviation Agency, Flight Standards Service, Maintenance Division, as Advisory Circular number AC 20-9.

PERSONAL AIRCRAFT INSPECTION HANDBOOK

Part I. INSPECTION FUNDAMENTALS

Section 1. THE INSPECTION PROCESS

Inspections

The term *inspection* as used in this handbook, means the examination of an aircraft to determine its condition. A routine inspection is one that is performed at predetermined intervals. "Spot" inspections are made whenever any apparent or obvious defect is found or when an unusual sound is heard.

The time intervals for the routine inspection vary with the aircraft involved. The manufacturer's service instructions should be consulted when attempting to establish these intervals. The information in this handbook will not tell you WHEN to inspect, but it will indicate WHAT should be inspected and WHERE to look for possible defects. To further assist you, the Federal Aviation Agency (FAA) publication, *General Aviation Inspection Aids*, alerts you to service difficulties others have experienced on identical products.

Preventive maintenance

Preventive maintenance means simple or minor preservation operations and the replacement of small standard parts *not* involving complex assembly operations. It can be best explained as corrective action taken *before* it becomes necessary to make a major repair. In a practical way, we know that this is theoretical; that try as we might, the aircraft components wear and sooner or later a repair must be made.

The habit of inspection

Inspection of your aircraft should become a habit. To establish this habit, begin by performing preflight inspections. Conduct detailed inspections at regular intervals using the manufacturer's recommendations, or in their absence, this handbook. Develop a *system* of inspection and an inspection checklist that will include the complete aircraft; once adopted, you should not deviate from this procedure. A few months of this and you will be surprised at how familiar you will be with your aircraft.

Scope of inspection

An aircraft inspection can range from a casual "walk-around" to a detailed inspection involving complete disassembly and the use of complex inspection aids. The inspections covered in this handbook can be performed by any person who has a basic knowledge of aircraft construction. These inspections can be made without disturbing the assembly of the aircraft other than to remove inspection access covers, fairings, and removable cowling. Most of the popular light aircraft can be inspected in about one hour.

Inspection systems

A thorough review of the aircraft manufacturer's service instructions will give you many helpful suggestions on how to make an inspection of your aircraft. Should you be unable to obtain such instructions the following suggestions may assist you.

Be certain you can afford the time necessary to regularly inspect your aircraft, or make arrangements with a qualified repair station or mechanic to perform the inspections. At the time this is done, you should make it clear exactly what the inspection is to cover. You should also require the person conducting the inspection to furnish you with a written statement of the results before performing any necessary corrective work.

It is important to develop a system whereby key safety items will always get priority. Two essential safety items are the *powerplant* and *flight control system*. These two systems

should be inspected in conjunction with each other. There are other inspection items, to be sure, but these two are of vital importance to safety.

When developing an inspection schedule for your aircraft, consideration should be given to climatic conditions, frequency and type of flight operation, contemplated periods of inactivity, and type of storage facilities used.

After you have determined inspection intervals for the powerplant and flight control system, you can determine periods for the rest of the aircraft components. A preferred method is to set your inspection intervals on the basis of flying hours. If your flying is done over the weekends, you may find it advisable to make your inspection on the basis of one or more different items each weekend. In either case, you have spread your inspection over a period of time that should be reasonable from a safety standpoint and without making unreasonable demands on your time. Here are some examples of both types of inspection intervals:

By hours

Daily preflight inspection.
Powerplant (including propeller and engine controls)—every 25 hours.
Flight control systems—every 25 hours.
Covering (fabric or metal)—every 75 hours.
Landing gear—every 50 hours.
Cabin or cockpit—every 100 hours.

By calendar weeks

Daily preflight inspection.
Powerplant and flight control systems—first weekend beginning the inspection schedule.
Landing gear—third weekend.
Cabin or cockpit—fifth weekend.
Covering—seventh weekend.

In some cases you might find it convenient to establish a combination of both methods for your inspection. Regardless of the method you choose, adhere to it faithfully. Do not presume that an item is in good condition, make a personal inspection each time.

For you to operate your aircraft, the Federal Aviation Regulations (FARs) require that it have a *periodic inspection* during the preceding 12 calendar months and approved for return to service by a certificated mechanic holding an inspection authorization, a certificated repair station, or manufacturer authorized to conduct the inspection. The Federal Aviation Regulations also provide for a *progressive inspection* that is acceptable in lieu of the periodic inspection.

• Since most inspections are based on aircraft operating hours, it is essential that logbooks be kept up to date.

The tools of inspection

The tools of inspection are many and varied, from a pocket-sized magnifying glass to a complex X-ray machine. For our purpose, only the tools required to make a simple routine inspection which may be performed by the aircraft owner are mentioned. These tools are:

A small eight-power magnifying glass
A small mirror
A flashlight
A one-inch wire brush
A dull-bladed knife
A round bristle brush and cleaning fluid
A hydrometer
Some lintless rags
A small kit of common hand tools (screwdriver, end wrenches, diagonal cutters, etc.)

A nonskid stepladder and wheel jacks should be available in addition to the above. If defects are noted requiring further inspections, call a certificated repair station or mechanic to inspect the items since many of them may require the use of tools not readily available to the aircraft owner. An example of such tools is the tensiometer to measure control cable tension.

• To preclude inadvertent aircraft damage or personal injury, the use of wheel or wing jacks on uneven or soft ground or under windy conditions should be avoided. If possible, jack and raise aircraft only in a closed hangar having a firm level floor.

Section 2. THE FORCES OF ATTRITION

The weapons of attrition

For the purposes of this handbook, attrition is defined as the general wear and tear of an aircraft during its normal life. The five basic weapons or forces employed by attrition are: weather, friction, overloads, heat and vibration. These forces reveal themselves in many ways and affect the entire structure of the aircraft during its normal life. It is important that the person making the inspection be familiar with the effects of these forces from an inspection standpoint. In the following pages these forces are discussed and the part that proper inspection plays in arresting their destructive development.

Weather

Weather denotes the local conditions of heat, humidity, rain, wind, snow, and so forth. Each element or combination of elements has its own peculiar effect upon the normal life of the aircraft. In succeeding paragraphs, these effects are discussed in some detail.

Oxidation. This is a condition caused by the chemical union of metal and oxygen in a damp atmosphere. We refer to oxidation as *rusting* when speaking of steel or iron parts. The oxidation of copper, aluminum, dural, and other similar materials is usually known as *corrosion.*

Rusting. The appearance of rust is well known to everyone. It usually begins as a discoloration of the metal surface. If permitted to progress undisturbed rusting will be indicated by a brown crustiness on the metal surface. Upon removal of the crust it will be found that pitting is in evidence. If the pits appear to be deep the part should be examined by an experienced mechanic who is qualified to evaluate the extent of the damage. Steel tube members of an aircraft equipped with floats should be given an especially close examination. It is possible for water to enter the interior of these members, thus allowing rust to form on the *inside* of the tube while the exterior appears to be in good condition. The best way to check for this condition is to have small holes drilled in the tubing when the airplane is resting in a level attitude. If water is present it will run out of the holes. A test of this nature should be performed by, or under the supervision of, a mechanic or repair station. Specialized experience and skill is required to determine where water is most apt to concentrate, also where and how to drill the tubing. The restoration of the area tested is at least a minor repair. In the case of a float plane, it is desirable to have small pieces cut from critical tubes in order to obtain positive knowledge of the condition of the tube interiors.

Rusting may be prevented or retarded by applying a protective coating to all metal parts. Usually this is accomplished by the application of a high-grade oil base or zinc base paint. Electrolytic plating is another method by which protective coatings are applied. In either case the important point is that the coating keeps the bare metal from coming in contact with the atmosphere.

Corrosion. Corrosion of aluminum surfaces is usually caused by damage to or deterioration of the protective coating which is designed to prevent oxidation. Corrosion can also be caused by the paint coming in contact with an eroding chemical such as battery acid, insecticide spray, etc. Contact between two dissimilar metals is still another cause of corrosion. Aircraft based or operated on or near water, especially salt water, are very susceptible to corrosion.

Ordinary corrosion of aluminum, magnesium, or aluminum alloy parts can be detected by watching for signs of surface flaking, pitting, or powdering. Corrosion is distinguished from staining or residual films by its white or grayish-white color while the latter has a brownish appearance. If pitting is apparent after cleaning off the flakes or powder film, an experienced mechanic should be contacted to make a determination of the damage. On aluminum or aluminum alloy surfaces that have been painted, watch for paint bubbles or blisters. Corrosion can take place under the paint; therefore, the suspected part should be cleaned to the bare metal and examined in the suspected area.

Atmospheric moisture. When the air is warm and moist it is referred to as being humid. Dampness is the term used to describe lower-temperature air laden with moisture. Both of these conditions are ideal for destructive oxidation.

Fabric surfaces and wood structures, like metal parts, if improperly protected, also fall prey to humidity and dampness and become subject to decay. Decay can be described as a disintegration of a wood substance due to the action of wood-destroying fungi. While the term "decay" generally refers to wood, it can also refer to fabric.

Decay of wood structure. The protective coating of a wood structure usually consists of a varnish treatment or varnish and some type of enamel paint. Whenever the protective coating deteriorates, decay can set in. Aircraft plywood is susceptible to decay especially at the ends of the lamination. Moisture can affect glued joints to the extent that the lamination separates and the thin veneer will then decay rapidly.

Wood properly protected with a coat of varnish will have a shiny appearance. Healthy wood will splinter if probed with a dull knife point; decayed wood will crumble or will break away in chunks. Weathering of the structure is first indicated by the surface appearing dull, which means that the varnish film has probably broken down. Be especially alert to wooden components positioned at points about the aircraft that are subject to collection of moisture and poor ventilation.

Decay of fabric. Decay of fabric is somewhat similar to that of wood. Fabric, if left exposed to the elements, soon absorbs moisture and other harmful substances. For protection the fabric is given applications of a liquid known as "dope." When properly applied, it acts as a tautener to the fabric in addition to producing a hard, smooth, opaque finish. In time this finish becomes brittle and will develop cracks which will then expose the bare fabric to the harmful effects of actinic sunrays, dirt, oil, and mildew. A gradual reduction of the fabric strength takes place to the point where it no longer maintains a strength value that is considered airworthy.

The effect of decay on finished fabric surfaces can only be ascertained by making a test. To determine if a test is necessary, examine the fabric surface. If the finish has been abraded by grit or sand, it will have worn down to the point where the fabric is exposed.

If a section of fabric is suspected to be weak, two kinds of tests may be made. One test may be made using a manual type tester and the other consists of sending samples of the fabric to a laboratory for analysis and evaluation against the appropriate fabric specification. A manual field test device provides an indication of the strength of fabric only as several factors are involved, i.e., temperature, humidity, and calibrated condition of the test. For conclusive test results, samples of fabric should be tested by a recognized testing laboratory under specified temperature and humidity conditions. It is recommended that a qualified repair station or mechanic make the manual test. If either one is not available, you should contact your local FAA inspector for advice.

Since re-covering of a surface is usually an expensive process, it is strongly urged that preventive maintenance be practiced. Washing of fabric-covered surfaces with mild soap and water at reasonable intervals will do much to prolong the life of dope and fabric.

Friction

Friction is described as the resistance to relative motion of two bodies in contact. Like any machine, the airplane in motion develops friction in hundreds of small moving parts. The effect of friction on the aircraft and its components is known as wear. Wear cannot be prevented but steps can be taken to deter its ultimate effects on the airworthiness of the aircraft by *proper* lubrication and alignment of moving parts. To better understand inspection techniques, a brief discussion of the terms used to describe the various conditions of wear due to friction follows.

Galling—a characteristic of certain materials which when in close contact with each other seize or "freeze" under friction, or pressure due to a lack of a lubricant, or the use of an improper lubricant.

Abrasion—a form of wear usually caused by the presence of gritty particles between mov-

ing parts. In some cases, the presence of abrasive substances can be felt in the controls and control surface movements. A part and its bearing being worn by abrasion have a gritty feel when rotated. Flight controls, and landing gear joints are susceptible to wear from abrasion.

Chafing—wear between two parts caused by the rubbing or sliding of one on the other. Chafed fabric, wood, or metal can easily be detected since chafing usually occurs between parts of the movable control surfaces coming in contact with fixed components. In this case, a degree of binding can be felt when moving the controls. The finish will also have worn appreciably at the point of contact.

Metal parts, when chafed, show a bright area wherever contact has been made. The simplest method of inspecting for this type of chafing is to visually follow through on control movements (both flight and engine) and landing gear. This may easily be accomplished by having another person operate these controls. Fuel and oil lines and electrical installations, in addition to movable control surfaces, should be frequently checked for indications of chafing.

Cutting—the presence of grooves in the worn part which can be easily detected. The cause of cutting is similar to chafing except that a sharp edge is in contact instead of a smooth surface.

Elongation—when the clearance becomes excessive between a loaded bearing surface and a rotating part, the bearing area tends to elongate; that is, to wear egg-shaped. For example, an elevator may have the control cable rigged so taut as to apply a positive pressure to one side of the hinge. After a certain period of operation, the bearing of the hinge will wear egg-shaped because the rotating action of the hinge pin is also exerting a thrust on the bearing due to its loading by the overtaut control cable.

• Always check to see if moving parts are properly lubricated by referring to the aircraft manufacturer's instructions.

Overloads

Personal aircraft are well designed to absorb the loads imposed during normal operation. When these loads are exceeded, however, the affected part usually becomes deformed which means that a serious structural weakness is present. Deformation of a part may be slight or very prominent, but it is ordinarily visible. In any case, it can be detected and classified by certain appearances peculiar to the type of overload that was applied.

In the majority of cases, a deformed part, besides losing its required strength, often places overloads on parts of the structure that are attached to it. Because of the possible presence of hidden damage, it is strongly recommended that a qualified mechanic, repair station, or if necessary, the aircraft manufacturer, be called upon to make a detailed inspection when an aircraft has been in an acccident or subjected to conditions where overloads could have been imposed on the structure. The following paragraphs provide essential information in cases where the services of a repair station or mechanic are not readily available.

Types of overloads

Tension. Tension is caused by a load applied at either or both ends of the item, tending to pull it apart. Welds are more often subject to failure due to tension than under any other condition of loading.

Overloads due to tension usually occur after a "hard" landing, after taxiing over a rough field, or during flight in very turbulent air. When a tripod landing gear first makes contact with the ground, the initial shock is taken by the shock-absorbing mechanism. Immediately after contact, the landing gear tends to spread out (the main wheels tend to thrust away from each other) thus axle members tend to become bent while the upper attachment point is in tension. After a hard landing, the points of attachment of all members should be examined for tension failures or deformation. Depending on the design of the landing gear, damage can be detected in the following ways:

1—The attachment fitting at the fuselage has pulled away from the fuselage structure.

2—The attachment fitting has failed where it has been welded.

3—The bolt holes in the fittings have either elongated or have been torn.

Essentially the same action and effects take place when a single-strut-type landing gear sustains a hard landing. When the aircraft is of all-metal construction, overloads are usually evidenced by wrinkling of the metal skin in areas surrounding the points of landing gear attachment.

When a strut-braced monoplane is in normal flight, the struts are continuously loaded in tension. When this type airplane encounters an unusually severe down draft, it is possible for the struts to be overloaded. Again, the strut attachment points should be carefully examined for the same indications of failure that have been described for landing gears. Special attention should be given to the strut fittings where they attach to the wing structure.

Compression. A part that has been subjected to a compression overload tends to bulge at the center in a direction 90 degrees to the applied load. In the case of tubing, a definite swelling at either extreme of the tube can be felt or seen. Sometimes this bulge is not pronounced but in any case, a break in the protective paint coating is usually noticeable.

Overloads due to compression are usually found after hard landings, accidents, or after flight through turbulent air. In cases involving hard landings, the shock-absorber members should be examined for failure in addition to fuselage members in the immediate vicinity of the fuselage attachment fitting.

A compression overload of a wood member can be detected by a slight ridge across the face of the member at right angles to the direction of the grain. Compression overloads are indicated in sheet metal or extruded aluminum alloy members by wrinkling or other forms of distortion.

Bending. A force or combination of forces that will cause a rigid member to curve or bow away from a straight line is known as bending. Overloads of this type, unless due to abnormal landing or flight loads, are generally caused by improper ground handling of the aircraft. Bent components will result from the following malpractices:

1—Stepping or pushing on wing struts.
2—Lifting the aircraft by the stabilizer.
3—Improper placing of work stands under longerons.
4—Overloading cabin or baggage compartments.
5—Exceeding turning limitations of nose steering mechanism.

On fabric-covered airplanes a bent structural member can usually be detected by looseness or wrinkling of the fabric covering the affected structure. Wood or metal skin may become cracked or deformed.

Torsion. A twisting force that tends to turn one end of a part about a longitudinal axis while the other end is held fast or turned in an opposite direction is called torsion.

Torsional overloads may be caused by a twisting force experienced during hard landings or if the wheels should catch in frozen ruts during a landing tending to distort the landing gear members. The control surfaces or other components will often twist as a result of severe air loads sustained during flight through turbulent air, or during abnormal flight conditions or flight maneuvers. Improper rigging adjustments to wings and tail surfaces may also cause twisting of these components. The inspection of these is similar to that described for tension overloads.

Certain single-strut landing gear have a torsional member referred to as a "scissor" or "nutcracker." A careful inspection should be made of this part for loose bolts and cracks, especially after a landing in a rough or rutted field.

Shearing. A cutting force applied to both sides of a part, but in opposite directions, which tends to cause the severed parts to slide toward each other is called shearing. The appearance of this type of deformation may be seen when attempting to cut material with a dull pair of shears or scissors.

Usually shearing of a part is the result of overloads in tension or compression. When any overload is applied the part having the least resistance to the force will be the first to fail. For this reason bolts, rivets, and clevis pins should be examined for signs of failure. This is especially important when it is found that the overloaded members do not show the usual indication of failure as previously de-

scribed. Failed bolts, clevis pins, and rivets may shear yet appear perfectly normal to the casual observer. To check for this condition, the following hints may prove helpful:

1 Bolts—If removal is not easily effected, apply torque to the bolt with a wrench. If it has sheared completely, one end of the bolt will rotate while the other end remains fixed. If the bolt is partially sheared, it may be rotated a few degrees and then become tight in the bushing.

2 Clevis pins—These are usually easy to remove for inspection. If not, check the alignment of the clevis pin head with the opposite end. They will not be in alignment if sheared or bent.

3 Rivets—Loose or sheared aluminum rivets may be identified by the presence of black oxide which is formed by the working of the rivet in its hole. This oxide will seep out from under the rivet head to stain the surrounding surface. Check rivet alignment where possible in the same way as described above for clevis pins.

Heat

The principal source of heat generated by the aircraft is the aircraft's powerplant. From the standpoint of inspection, we are interested in two kinds of heat; namely, direct and indirect.

Direct Heat. The cause of direct heat is exhaust gases. At the same time there is also indirect heat radiating from the exhaust system components in addition to the hot gases or flame coming from the exhaust outlet. Leaks in the system will allow harmful gases to find their way into the cabin. Severe leaks from or failure of exhaust system components can allow the escape of flames with disastrous results.

To forestall serious hazards, the exhaust pipes, clamps, bolts, braces, and welds should be examined at regular intervals. Exhaust gaskets must be in good condition. The nuts holding the exhaust pipe or manifold to the cylinder must be properly torqued and safetied. Loose exhaust pipe bracing should not be permitted since it allows the pipe to vibrate which in turn causes failure at the welds and leaks from the flange surfaces. Heater muffs or shrouds should be removed to allow inspection of the exhaust system components that are covered by the shrouds.

Indirect heat. Indirect heat emanates from the operation of the engine proper and is carried off by the action of the air stream passing through the cowling. If the air stream is unable to carry the heat away, high internal and ambient engine temperatures occur with resulting harmful effects to the engine and may cause failure of accessories or other parts of the powerplant assembly. Excessive indirect heat may be indicated by some of the following:

1—High oil temperature.

2—High cylinder head temperatures.

3—Blistering of the paint covering adjacent parts within engine compartment.

4—An odor of burned oil or hot rubber is noticed during or after engine operation.

5—Auto-ignition upon shut down of the engine (engine tries to continue functioning).

If any of the above indications are observed, immediate steps should be taken to trace the trouble to its source. Often the difficulty can be found as loose or leaking engine baffles and cowling or improper rigging of carburetor heat door and control. Dirty oil coolers and screens, improper grade of oil, and oil leaks are other items to be considered. In any case, once the signs of excessive heat are in evidence, a detailed check should be made by a repair station or a mechanic.

Vibration

Vibration is the source of many malfunctions and defects that occur throughout the life of the aircraft. Not only will it affect parts that are loose or poorly installed but it will also accelerate wear and cause ultimate failure of other parts.

There are two types of vibration in aircraft operation; namely, noticeable and unnoticeable. Noticeable vibration is caused by a malfunctioning powerplant, worn engine mounting

pads, propeller, or a loosening of the aircraft structure.

The unnoticeable vibration is caused by inherent vibration characteristics of the rotating masses in the engine and propeller. It can also be caused by aerodynamic forces acting through the propeller or by engine firing impulses. Unnoticeable vibration is usually charted by special instruments at the time the aircraft is type certificated by the FAA. Where harmful vibration frequencies are found to be present during original certification flights, it is required that placards be installed that will indicate to the pilot the engine operating ranges which must be avoided.

Noticeable vibration. Noticeable vibration should be corrected as soon as discovered since it will cause abnormal wear between certain moving parts of the aircraft and may induce fatigue failure in any number of other aircraft parts. To better understand this, the factors of vibration damage can be grouped into three categories: fatigue, excessive clearances, and poor installation. These points should be considered when inspecting for the after effects of vibration.

FATIGUE. When a part is subjected to repeated stresses, its strength properties become greatly fatigued or weakened. This is due to a change in the molecular structure of the part caused by constant reversals of stresses. For example, a piece of metal wire, if bent back and forth a number of times, will fail from fatigue. Unbalanced crankshafts will develop a vibration "whip" which in time will cause the shaft to fail at the point of greatest stress.

With the above in mind, it can be easily understood why the various components must be properly mounted and secured to resist the damaging effects of vibration. Copper fuel and oil lines are especially susceptible to fatigue failure because they become hard and brittle due to vibration. Periodically the lines should be replaced or removed and annealed to restore the original softness.

Fatigue means the weakening and eventual failure of a member due to the cumulative effect of repeated or cyclic loads during service. Fatigue itself cannot be detected or measured while it is taking place except possibly under laboratory conditions. Its effects are usually made known by the ultimate failure of a part. The best preventive for damage due to fatigue is to maintain a smoothly running powerplant In addition, control excessive or abnormal looseness in other components of the aircraft by good maintenance practices, particularly engine mounting pads which are designed to isolate and absorb vibration.

EXCESSIVE CLEARANCES. Vibration, because of excessive clearances at hinge points and other parts, is a common cause of an aerodynamic condition known as flutter. Flutter causes a shaking or quivering, unnoticeable at times, in the affected movable control surface thereby setting up fatigue stresses in critical areas such as control surface hinge fittings and attachments. Wear at the hinge points can accelerate rapidly during periods of flutter. For this reason, hinge bolt or pin clearances should not be allowed to increase beyond a safe maximum.

INSTALLATION. Installation, as it is used here, is the proper arrangement of the various parts in relation to each other. A fuel line, for example, may have sufficient clearance relative to another part, yet under vibration it may move and make contact with the other part and become chafed.

Ignition or electrical cables may be in contact with each other and appear perfectly rigid during normal operation. However, during periods of vibration, they will rub together and may wear through the protective casings. Every part of the aircraft, especially control cables and engine installation components, should be carefully examined for signs of chafing or cutting. If vibration has gone uncorrected for a considerable period of time, all nuts, bolts, clamps, etc., should be checked for looseness.

It should be mentioned that propellers have inherent vibration characteristics. These vibrations are not usually harmful but they can induce fatigue and may cause failure of certain parts which may be essential to the airworthiness of the aircraft. Quite often a pro-

peller becomes nicked, especially at the leading edges; if the nick is deep enough it be comes a point of stress concentration. It is IMPORTANT that nicks be removed as soon as possible and in a proper manner. Since the removal of deep nicks requires special skills and tools and a thorough knowledge of the procedure, such work should be accomplished by a qualified person.

DO's and DON'Ts

DO have an assortment of proper tools for inspection.

DO use an inspection check form.

DO use a regular inspection procedure and STICK TO IT.

DO remove all inspection plates and cowlings.

DO clean thoroughly all items to be inspected.

DO check that all moving parts are properly lubricated.

DO familiarize yourself with proper safetying techniques.

DO inspect for proper safetying.

DO check the "jam" or locking nuts on push–pull controls or adjustment devices.

DO resafety a part you have unsafetied before inspecting the next item.

DO consult with authoritative advisers if the occasion arises (a certificated mechanic, an approved repair station, or your local FAA inspector).

DON'T check landing gear by kicking it—raise it off the ground.

DON'T be hurried—take plenty of time to properly inspect each item.

DON'T move the propeller unless the magneto switch reads "OFF," or the ignition system is otherwise rendered inoperative.

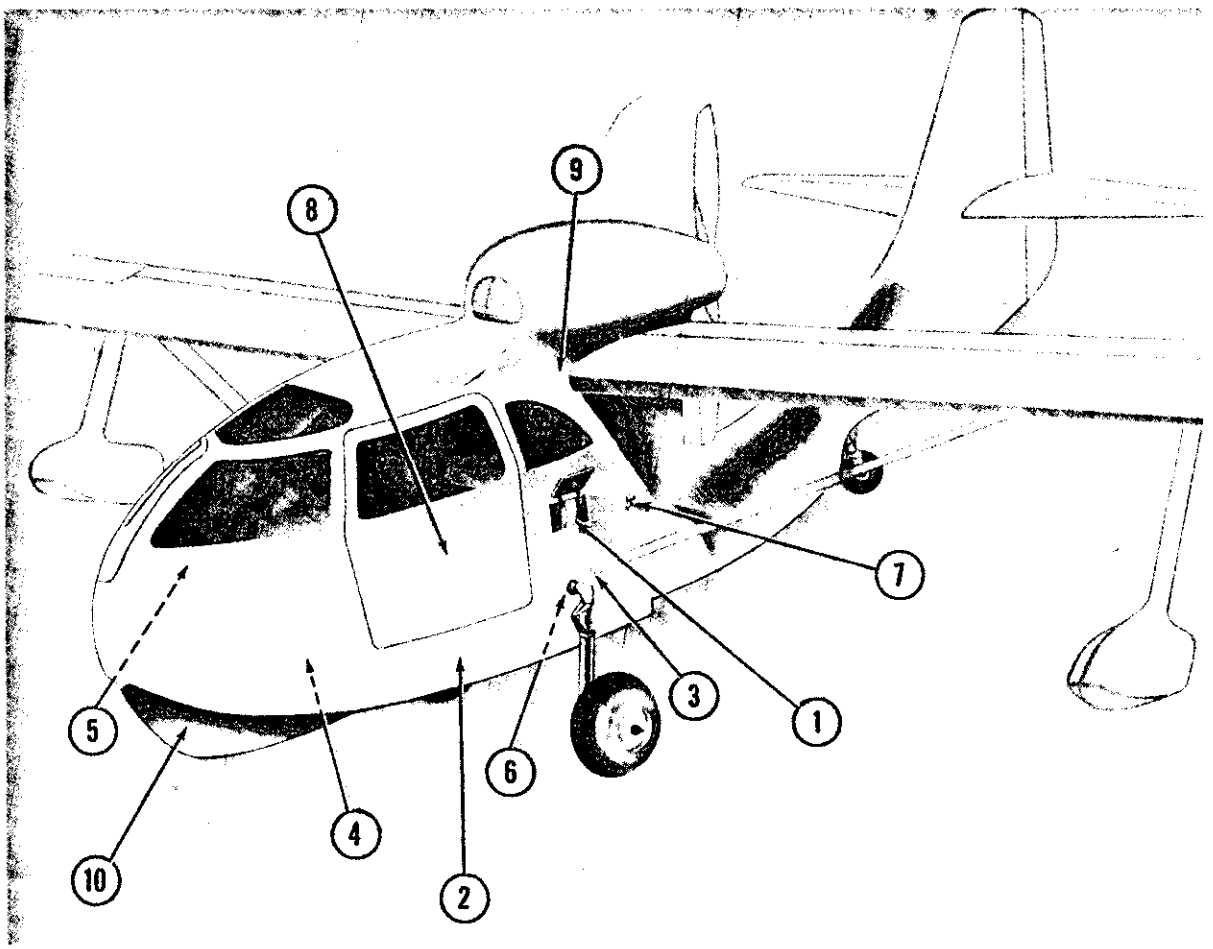
DON'T neglect hard-to-reach items.

DON'T presume an item is airworthy before or until checking it.

DON'T be embarrassed about asking questions.

DON'T perform any complex inspection or maintenance operation unless you are properly supervised by a certificated mechanic.

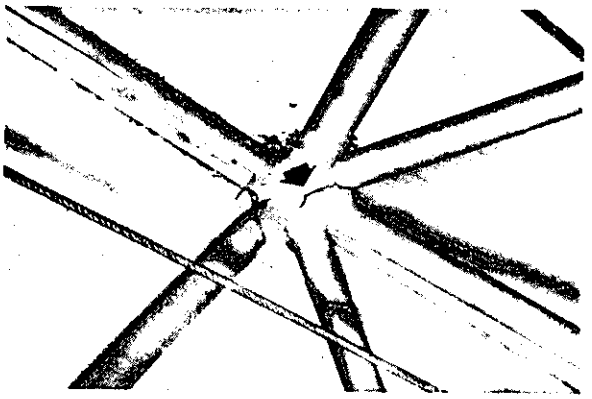
INSPECTION CHART — Fuselage—Hull



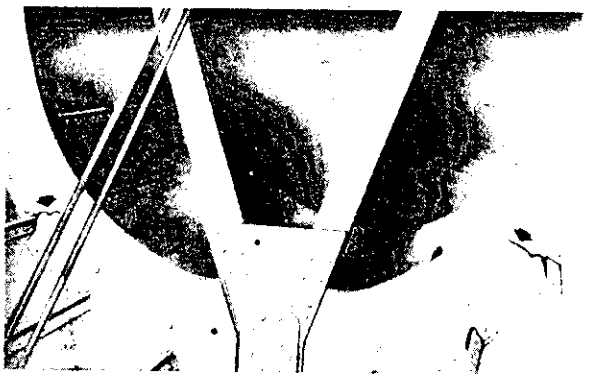
Part II. INSPECTION TECHNIQUES

Section 1. FUSELAGE—HULL

Before starting the inspection, be certain that all plates, access doors, and fairings have been opened or removed and the structure cleaned. When opening inspection plates and cowling, prior to cleaning the area to be inspected, take note of any oil or other foreign accumulation which may offer evidence of fluid leakage or other abnormal condition that should be corrected. This procedure serves to properly reflect the actual condition of the item being inspected.



Cracked fuselage structure.



Cracked bulkhead.

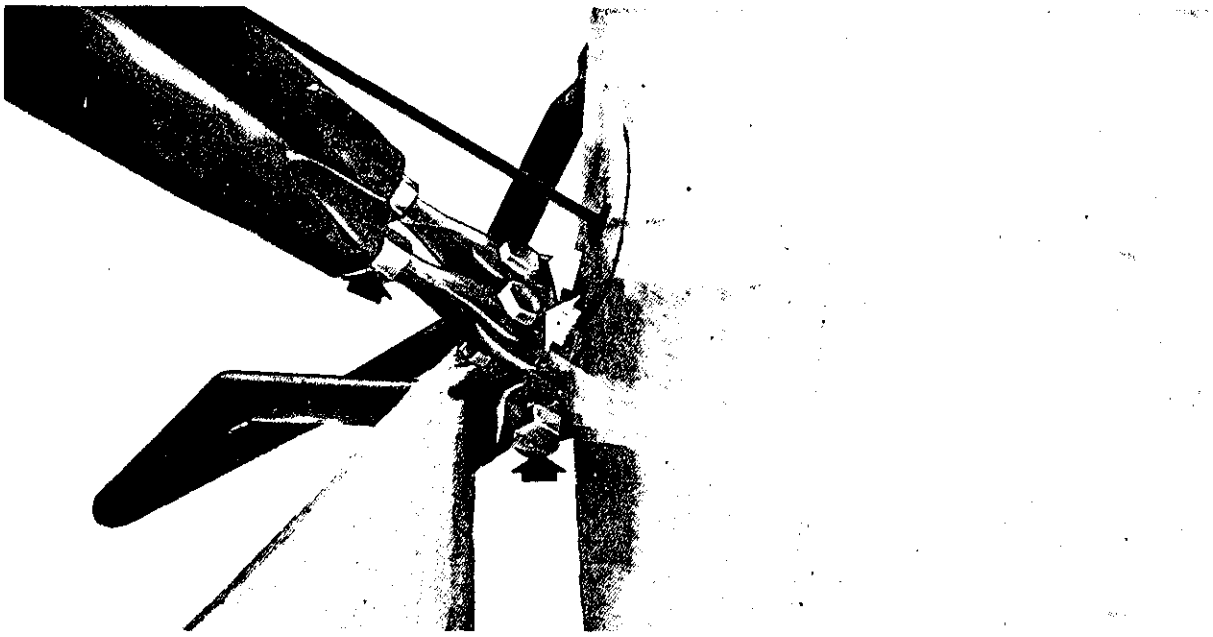
1. Examine the interior fuselage structure through access doors and inspection openings. Look for bent longerons or braces; cracked tubing or bulkheads; loose bolts, rivets, and structural members. Carefully inspect the airframe structure (using a magnifying glass) at the wing, strut, and landing gear attachment fittings. Look for cracks, poor welds, or elongated bolt holes. Determine that the structure is free from corrosion, rust, deterioration, or other obvious defects.

Worn or damaged structure and components that are defective should be repaired or replaced in accordance with pertinent Federal Aviation Agency publications and the manufacturer's instructions as appropriate.

Distorted fuselage skin.

Deteriorated fuselage fabric.

2. Inspect fabric or skin for tears, distortion, deterioration, or other defects; check the condition of protective coating. Be sure that the fabric or skin attachment to the structure is satisfactory and that there are no pulled rivets, loose or missing screws, or broken rib lacing. • If the condition of the fabric cannot be positively determined, a test should be made by a qualified person to determine if the fabric meets the minimum strength requirements.

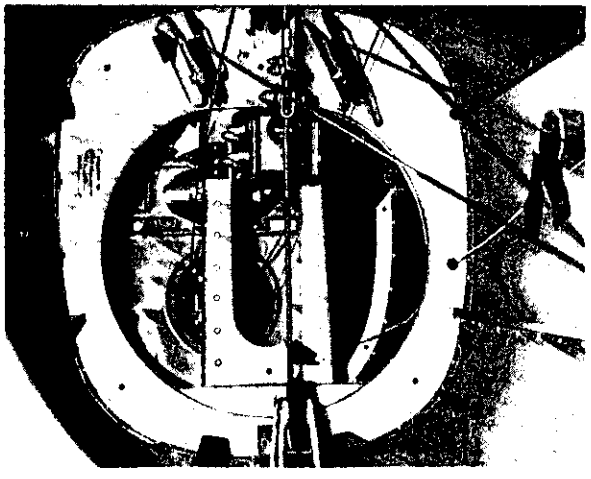


External wing bracing attachment checkpoints.

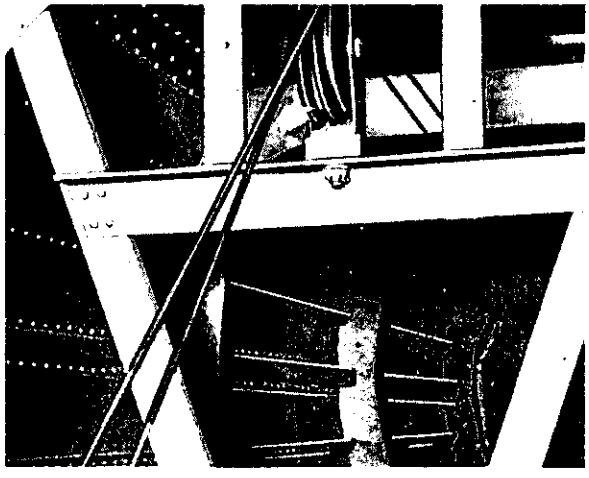
3. Check external bracing and attachment fittings for distortion, cracks or any other imperfections; check struts or brace wires for condition and security of attachment. Check adjustable ends for cracks, excessive bearing wear, worn or damaged threads, loose locking nuts, and any other apparent or obvious defects.

• Struts may be damaged due to stepping on them when entering or leaving the aircraft, or by mishandling when lifting or moving the aircraft. Damaged wing brace struts may be repaired if the work is done in accordance with instructions contained in pertinent Federal Aviation Agency publications or the manufacturer's instructions. Generally, it will be preferable to replace the damaged struts with new or serviceable units.

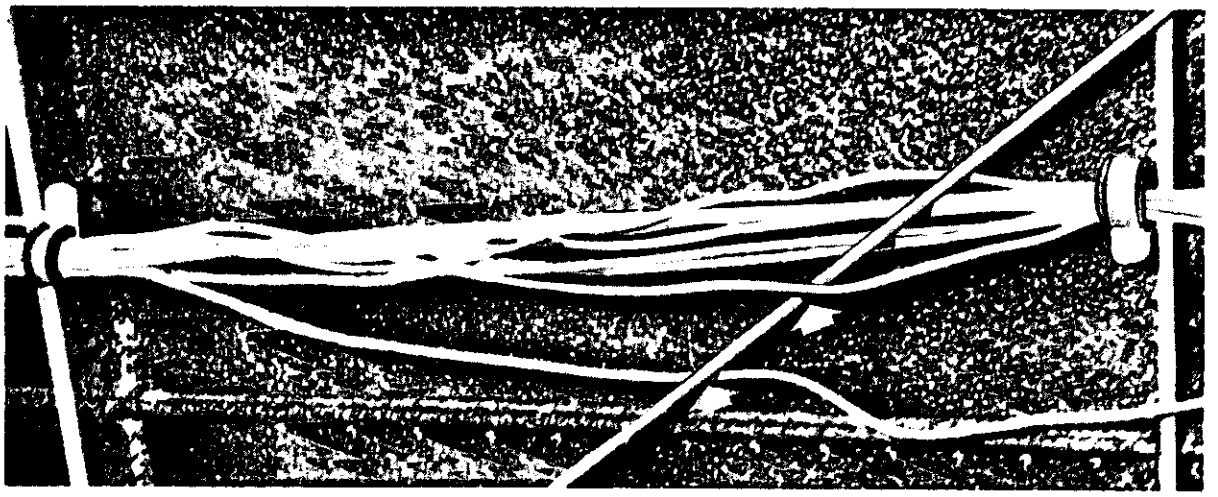
4. Examine control system mechanism for condition and proper operation. Inspect bellcranks for cracks, proper alignment, and security. Check cables for proper tension and routing through fairleads and pulleys. Rotate



Proper cable routing.



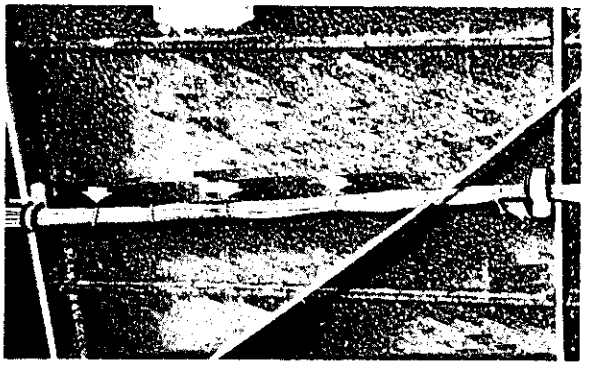
Improper cable routing (crossed).



Wires fouling control cable.

pulleys to check for flat spots, to provide new bearing surfaces for cables, and to check for smooth, free operation. Inspect hydraulic valves, actuators, and boost controls, if installed, for general condition, leaks, security of attachment, freedom of operation, and other obvious defects. Particular attention should be given to flexible hoses carrying fluid under pressure to or from the hydraulic components.

• Wires and control cables should be replaced if damaged, distorted, worn, or corroded, even though the strands are not broken.



Satisfactory wire installation.

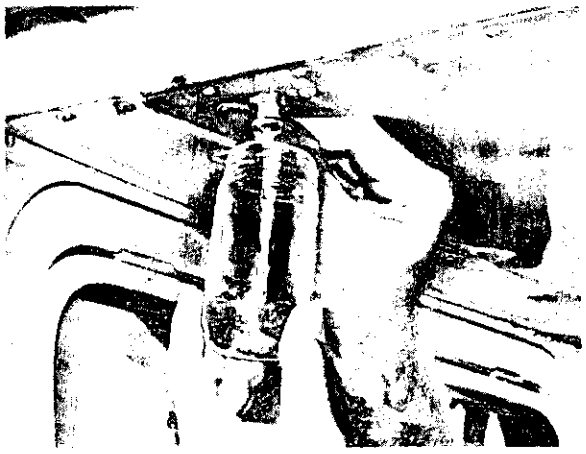
5. Check electrical wiring for proper installation and security of attachment. Check for chafing, and general condition. Inspect installation of grommets, plastic tubing, and connectors. Determine that solder is not deteriorated or corroded on all electrical connections and that terminals are not weak or misaligned. Inspect switches, fuses, and circuit breakers for proper condition.

• Wiring that has been damaged as a result of chafing should be replaced and the cause of chafing corrected.

Leakage from chafed hydraulic line.

6. Inspect hydraulic system lines for leaks, dents, kinks, cracks, or chafing and for security of attachment. Inspect valves and other components for leakage. Inspect fluid reservoir for proper fluid level.

• If leakage cannot be corrected by tightening connections or replacement of packing, a serviceable unit should be installed.

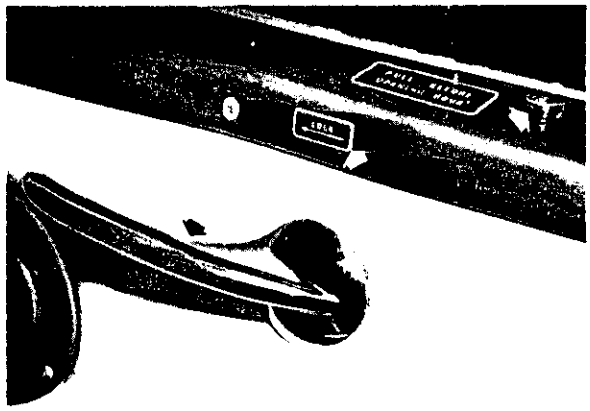


Draining fuel tank sump.

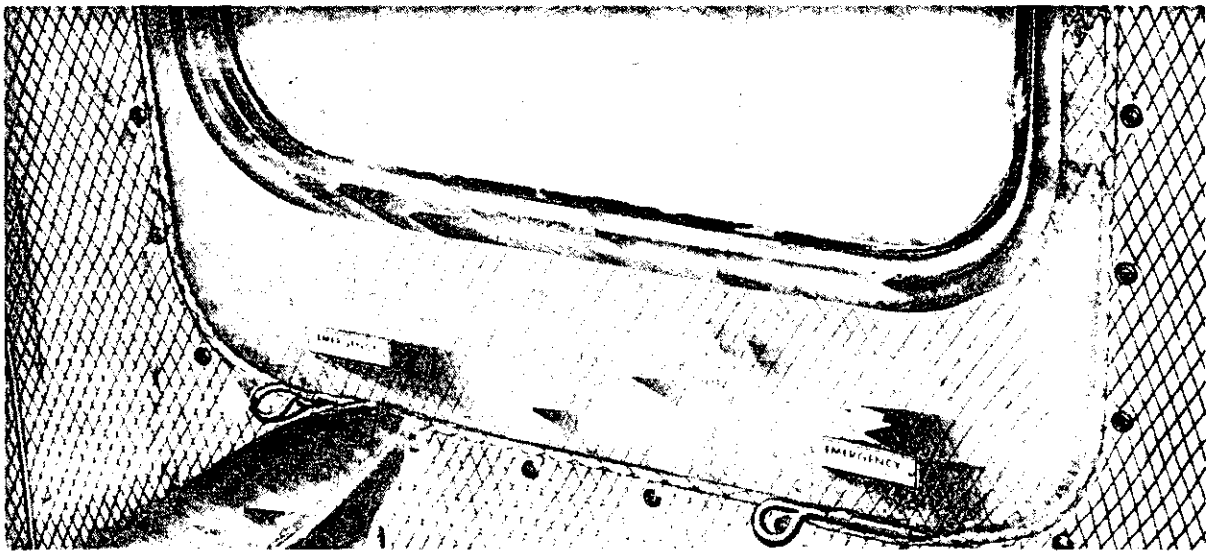
7. Inspect fuel tanks and filler caps for proper alignment, security of attachment, and evidence of leaks. Be certain that vents and vent lines are free from obstructions. Examine fuel lines and connections for leaks, cracks, security of attachment, and chafing. Assure that overflow and drain lines are not kinked or broken and that they extend beyond the aircraft structure.

Fuel systems incorporate either a fuel tank sump and/or a sediment bowl (gascolator) to trap water and sediment. To prevent accumulation of water that can pass through the fuel lines to the engine causing engine stoppage, periodically drain a sufficient amount of fuel from the tank sumps, if installed, or sediment bowl, and examine for water or other contamination. Replace drain plugs and safety.

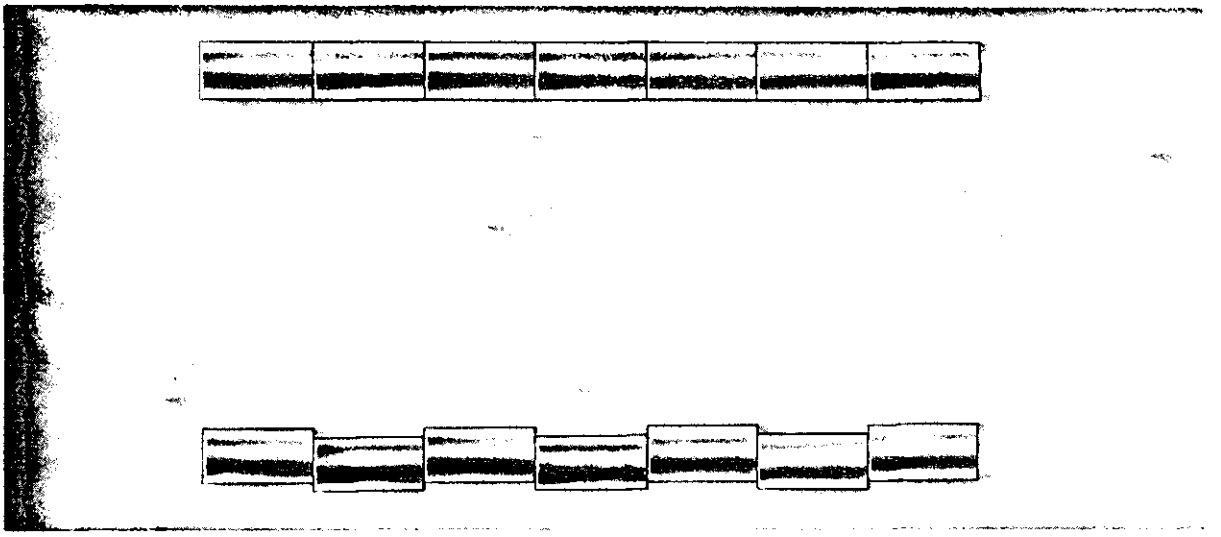
• Tests have shown that as much as 10 ounces of fuel had to be drained before there was an indication of water in the tank. If a considerable amount of water is detected in the main fuel strainer, the carburetor, fuel lines, and tank sumps should be immediately drained. If the fuel dispensing system is thought to be contaminated, it should not be used until the contaminants are removed. In an emergency fuel can be strained through a chamois skin into the aircraft fuel tank. Take the necessary safety precautions, paying particular attention to neutralizing static buildup by using a ground.



Door locked.



Emergency exit checkpoints.



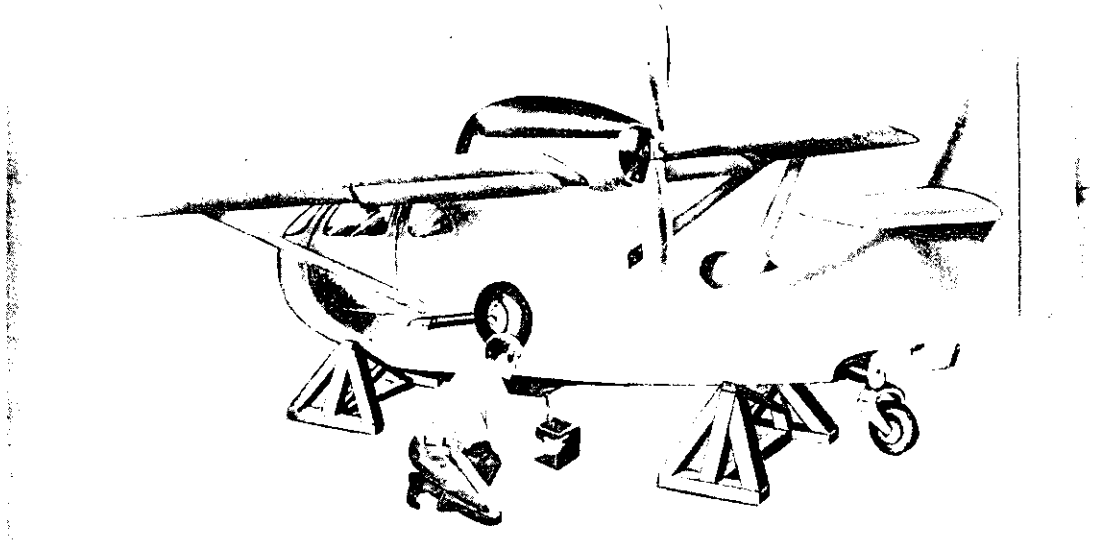
Piano hinge alignment.

8. Inspect cabin and/or cockpit entrance doors and emergency exits for general condition. Check them for ease of operation and for security of attachment. Remark or repaint emergency exit placards if the markings have become illegible.

• Assure that the doors and emergency exits can be opened from inside the aircraft, and can be positively locked to prevent inadvertent opening during flight.

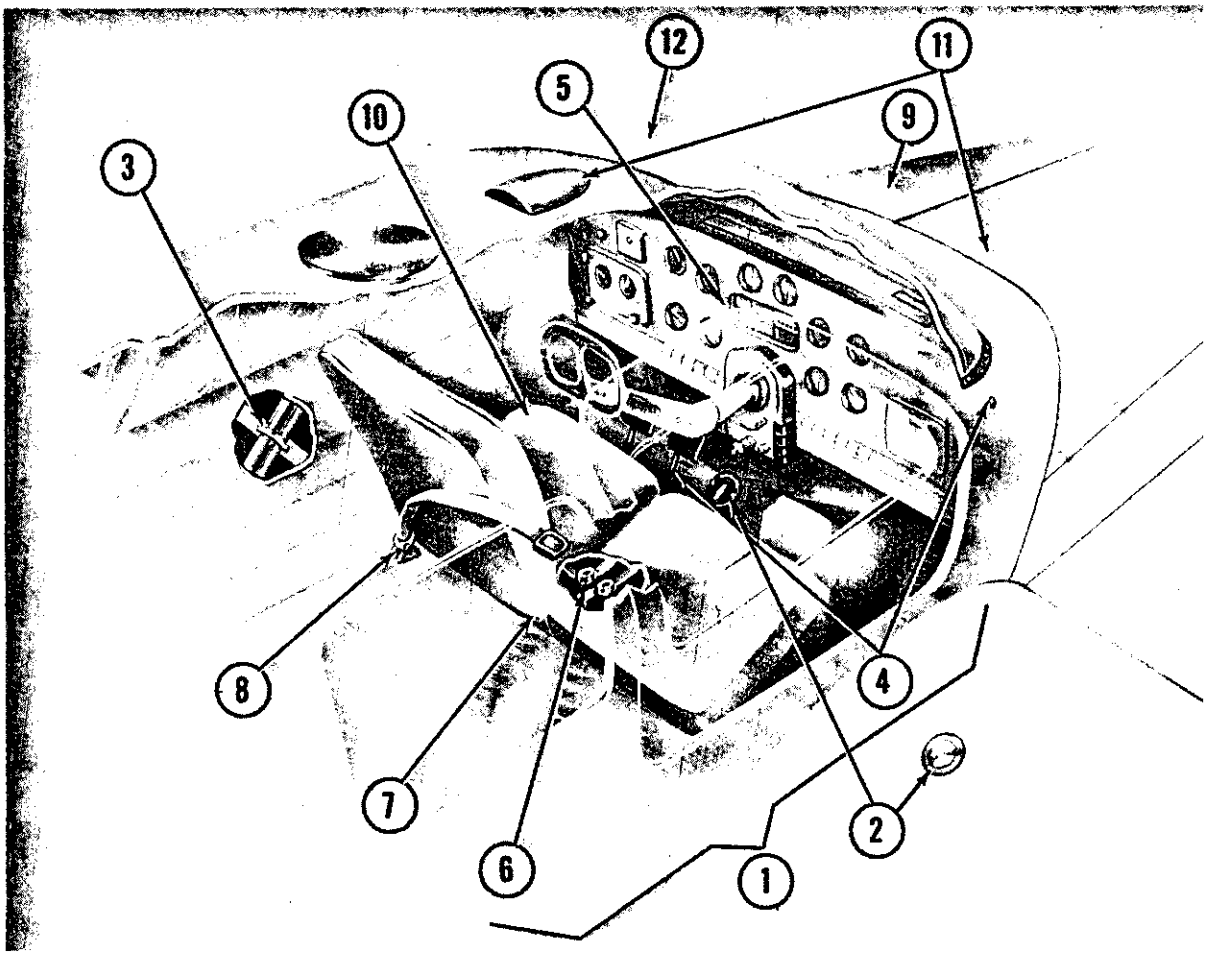
9. Examine baggage compartment for general condition. Inspect floor for defects. Check door hinges and locks for condition and satisfactory operation.

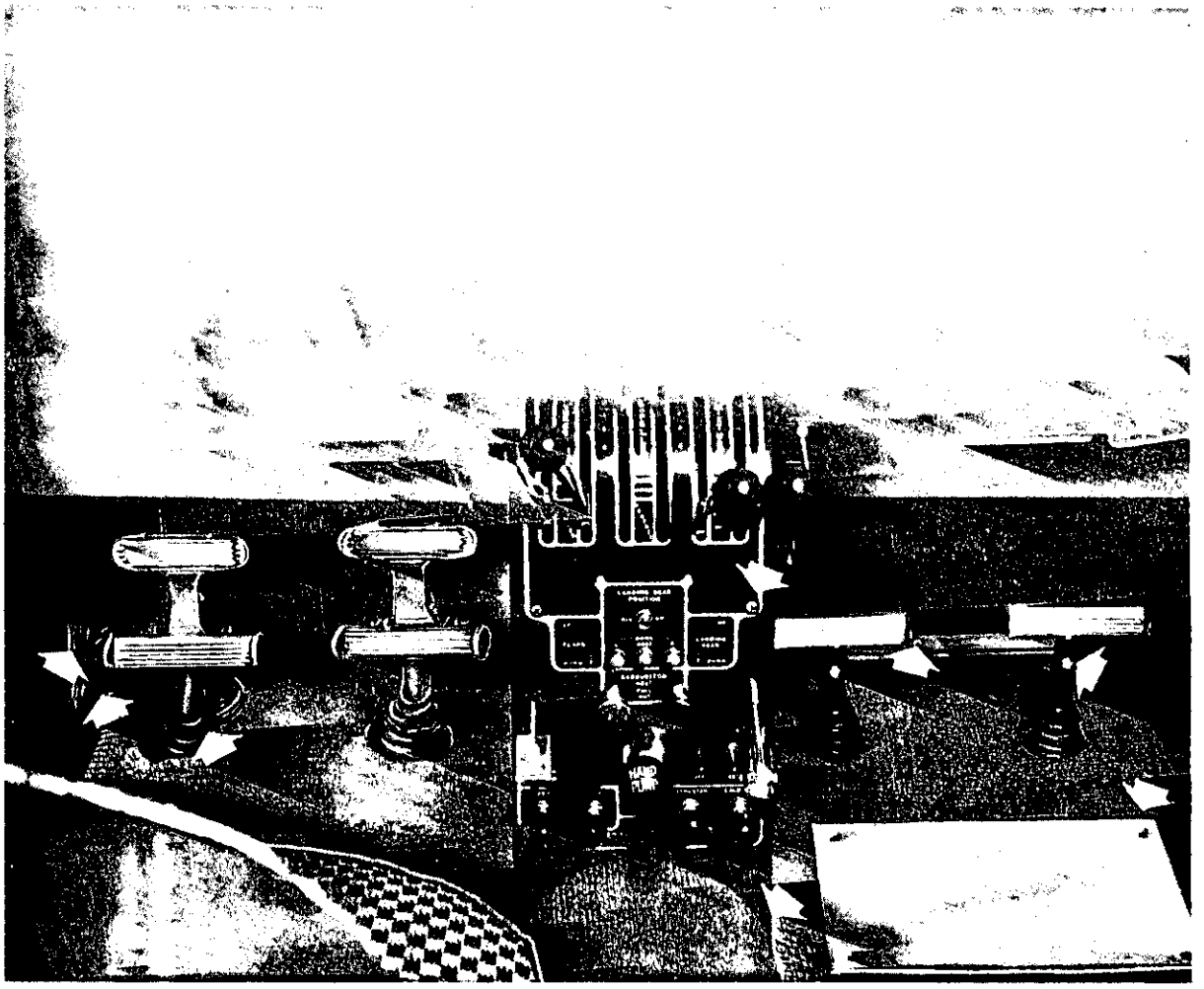
10. If applicable, examine hull for damage or obvious defects, such as corrosion, deterioration, loose rivets, and screws. Inspect seams for separation. Accumulation of liquids in the bilge should be drained; the presence of any appreciable amount will affect the aircraft center of gravity. Be certain that all drain plugs have been reinstalled and secured.



Draining bilge.

INSPECTION CHART — Cabin—Cockpit

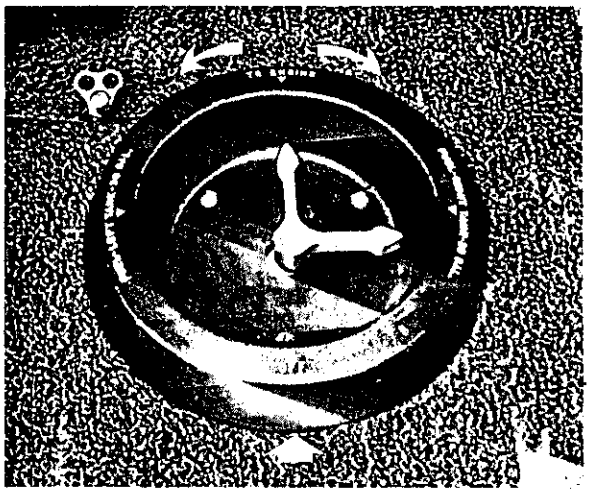




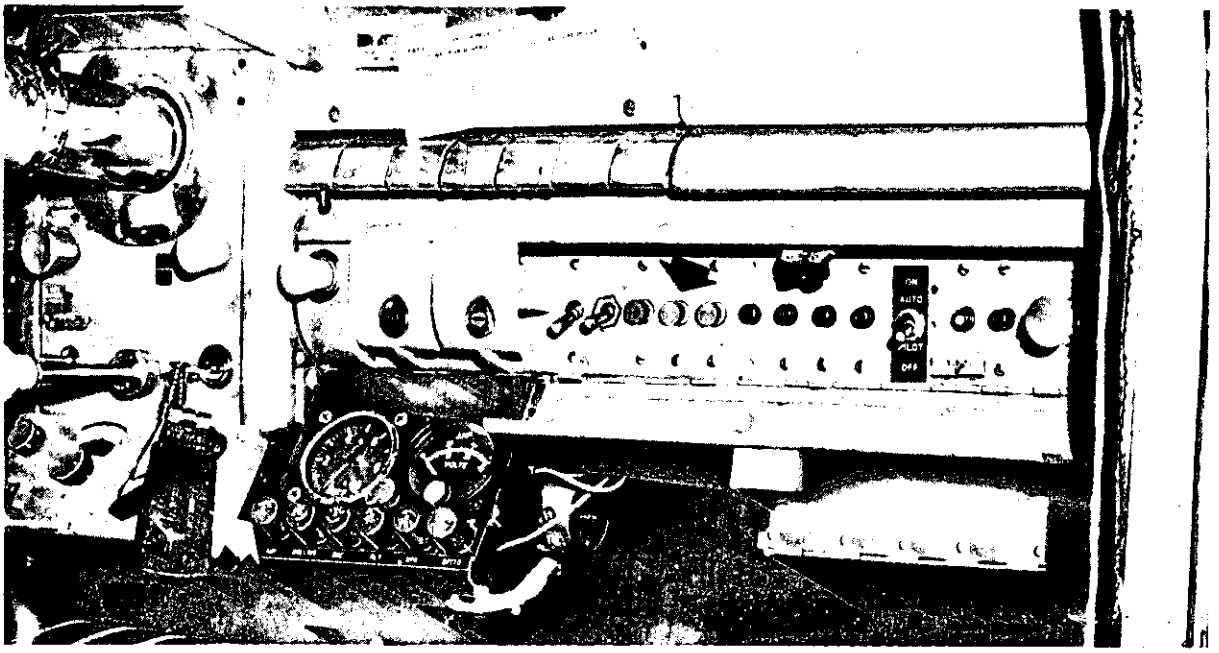
General condition checkpoints.

1. Inspect cabin and/or cockpit for general condition, cleanliness and presence of loose articles which might interfere with the controls. Using a flashlight, inspect under the instrument panel for loose wires and leaks in instrument lines. Check operation of controls for possible interference and for full travel.
2. Check selector valve(s) for leaks, freedom of movement, and satisfactory operation. Check fuel gauges for accuracy. Check engine primer assembly for leaks and operation.

• Any binding, leaking, or unsatisfactory operation of the fuel tank selector valve should be corrected immediately.



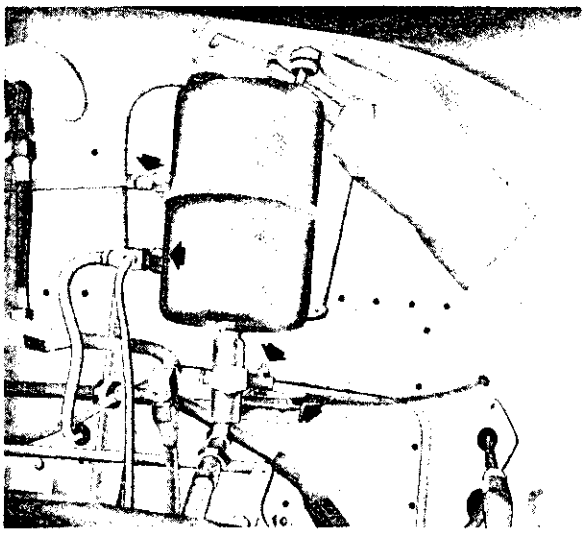
Selector valve operational check.



Fuse and circuit breaker panels.

3. Inspect electric wire bundles for general condition, chafing, and routing. Examine connections at terminals, junction boxes, cannon plugs, and clips for looseness and obvious defects. Check condition and operation of circuit breakers, fuses, and switches. Check voltage regulators and reverse current relays for general condition and operation.

• Fuse clips (including spares) must hold fuses securely yet permit easy removal. Replace burned out fuses with fuses of proper type and amperage value. Insure that fuse clips are free of corrosion.



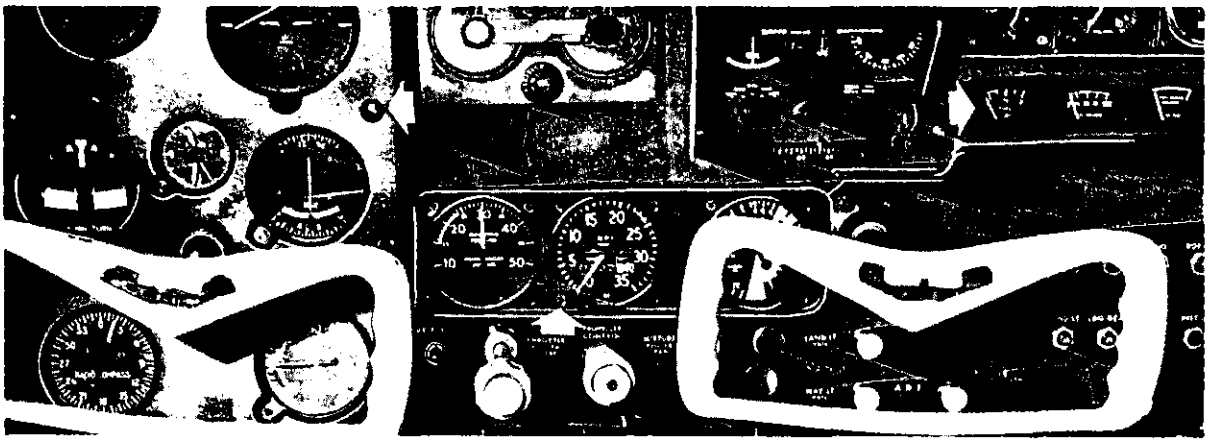
Checking hydraulic fluid level.

4. Inspect the hydraulic system reservoir for general condition, security of attachment, and proper level of the fluid. Examine the pressure accumulator for obvious defects. Check pumps for security of mounting and condition. Inspect bypass valves and relief valves for leaks. Assure that lines are properly secured and free from leaks, dents, kinks, cracks, or chafing.

• Air and dirt in hydraulic systems are the most frequent causes of faulty operation. Air causes faulty release, irregular pressure, and noisy operation. Dirt and grit affect valve operation and produce leakage by cutting the various packings throughout the system.

When replenishing hydraulic fluid reservoirs, NEVER mix dissimilar hydraulic fluids. This "mixing" can result in complete system failure. Care should be exercised when servicing hydraulic systems, to avoid spilling fluid on the aircraft or components.

5. Inspect all instruments for security of attachment, cleanliness, legibility of dial markings, security of glass dial covers, proper marking, and general appearance. The magnetic compass should be checked regularly for proper



Instrument panel.

fluid level and accuracy; enter any noted deviations on the compass correction card. Check instrument panel indicating and warning lights for operation, condition, and security. Replace inoperative bulbs.

• Any lines that show signs of deterioration should be replaced. Inspect the instrument panel for freedom of movement and shock mounts for signs of deterioration. The panel should not come in contact with any part of the aircraft structure or any line or component rigidly attached to the aircraft structure.

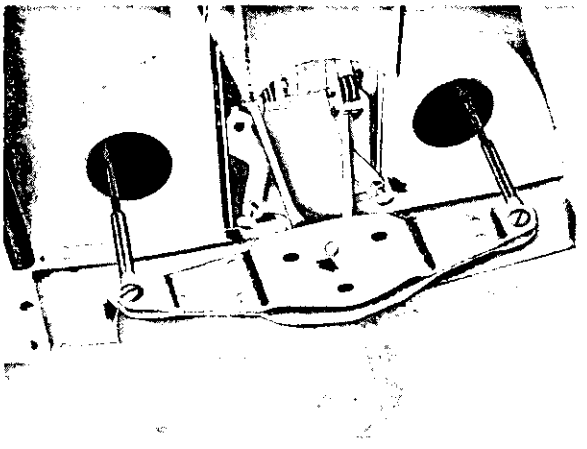
When suspected of malfunction, operation of flight instruments should be checked during a test flight or with a portable ground test unit. A periodic check of vacuum operated instruments is recommended to prevent erratic operation due to dirty filters. Dirty filters should be replaced.

• Malfunctioning instruments should be removed and replaced or forwarded to an approved instrument shop for necessary repairs.

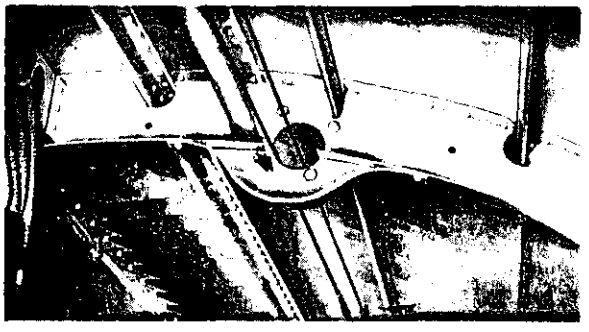
6. Inspect all control linkage for proper functioning and general condition. Check cables for frayed strands and proper tension. Examine pulleys and fairleads for misalignment, breakage, or looseness. Inspect bellcranks and torque tubes for alignment, cracks, freedom of movement, and proper safetying. Determine that the pulleys and fairleads through which the control cables pass are clean and that the surrounding structure in no way interferes with their movement. Operate the various controls to be sure that there is no lost motion, binding, or chafing.

• If inspection reveals that cables have been chafing against some portion of the structure, they should be replaced if excessively worn and the new control cables realigned.

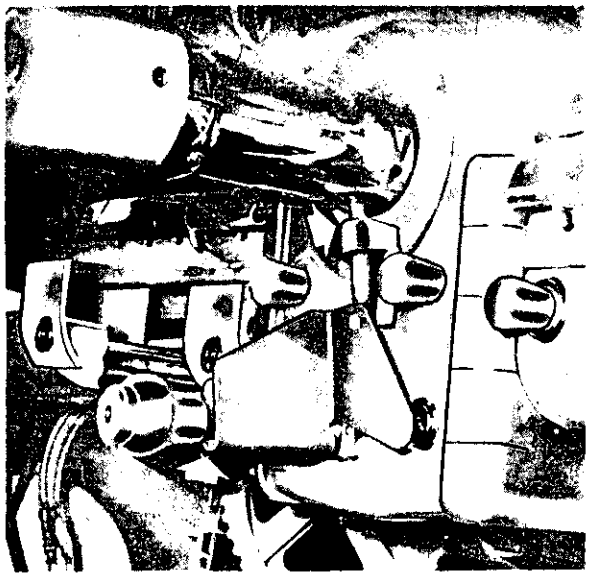
Inspect gust locks, if installed, for condition. Assure that they release completely and cannot possibly engage inadvertently.



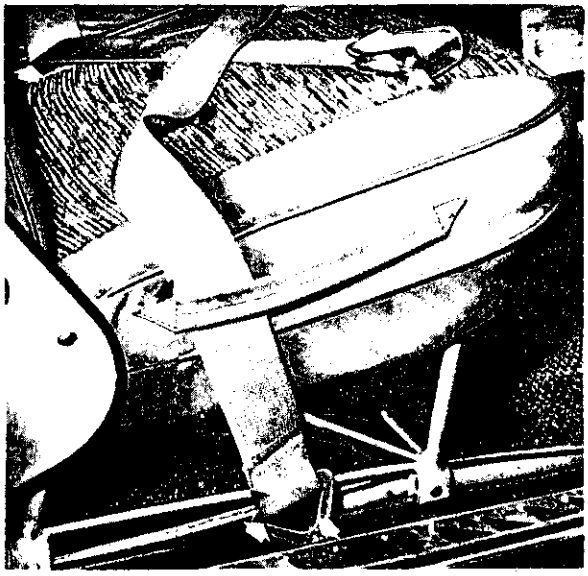
Bellcrank inspection points.



Cable rubbing bulkhead.



Gust lock mounted on throttle.

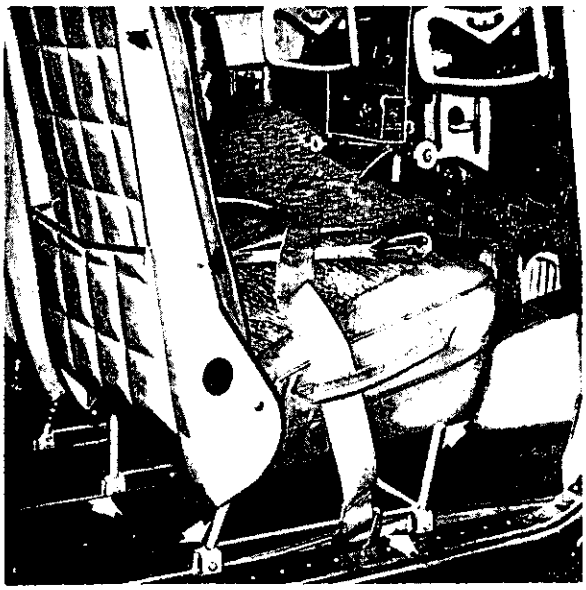


Safety belt points of wear.

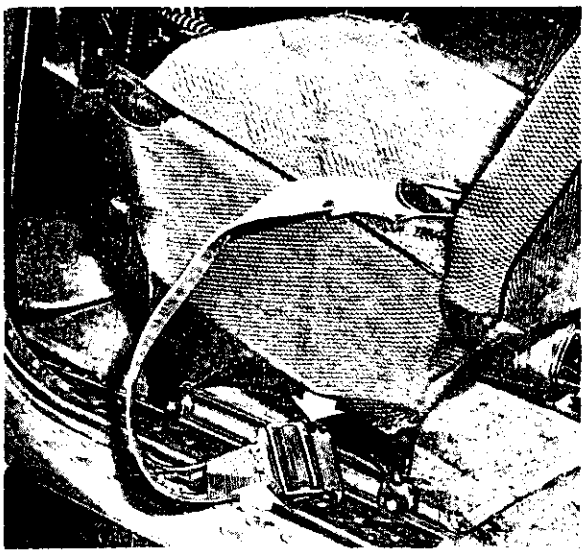
7. Inspect all seats and/or berths for security of attachment, condition and functioning of adjustment mechanism, and for breaks or cracks in the seat structure.

8. Inspect all safety belts and shoulder harnesses for cuts or fraying of the material, and for excessive exposure to the deteriorating effects of sunrays, acid and dirt. Make certain that the latching devices are in good condition and operating satisfactorily. Assure that all fittings and attachment parts are secure and in good condition.

• Safety belts and shoulder harnesses that show evidence of cuts or fraying should be removed and replaced with approved-type belts.



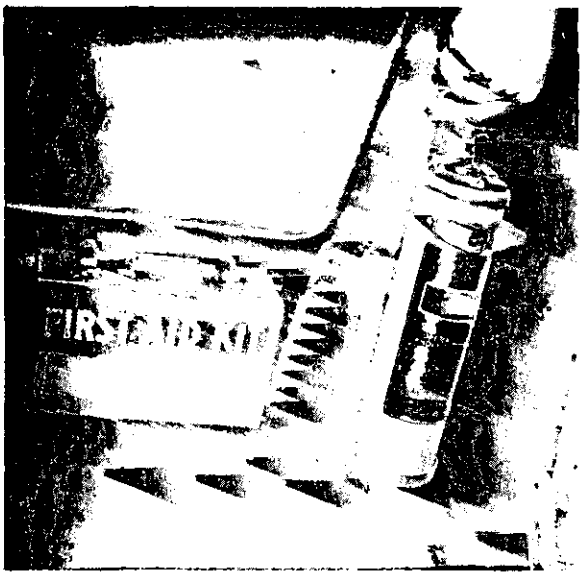
Inspection items on seat.



Example of frayed safety belt.

9. Examine the fire warning and detecting system for security of attachment and general condition. Assure that wiring connecting the sensing devices and the indicating instrument show no evidence of chafing or deterioration.

Fire warning sensing device.



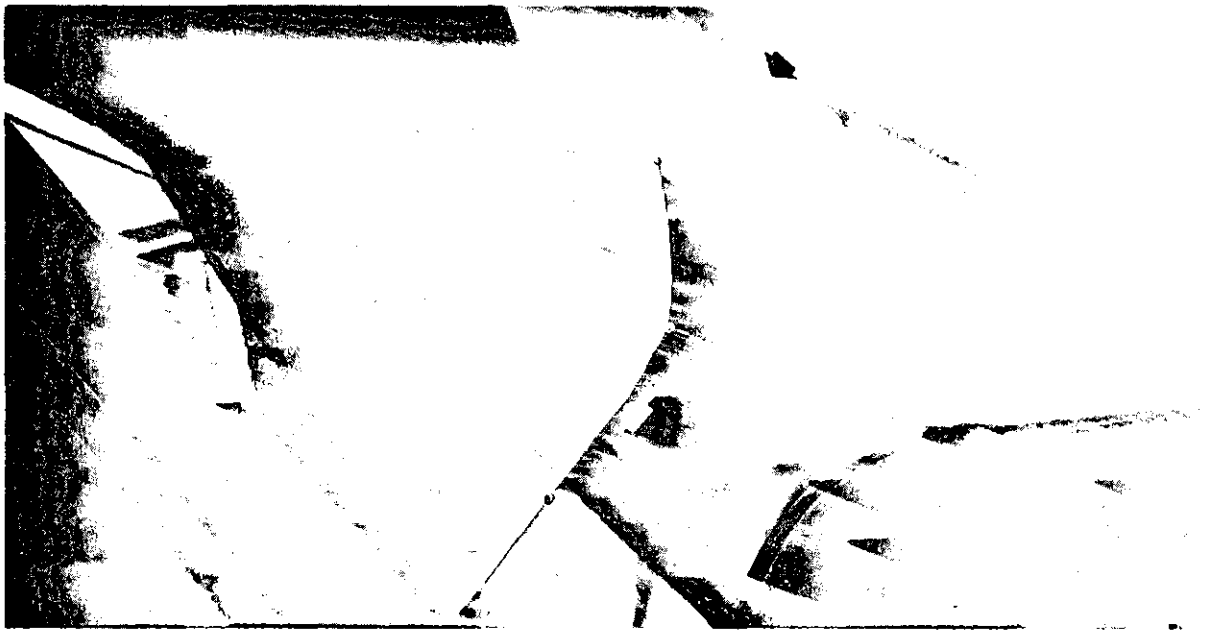
Fire extinguisher installation.

10. Inspection and maintenance of fire extinguishers should be in accordance with the manufacturer's instructions attached to the extinguisher unit. Assure that the extinguisher is fully charged. Inspect for general condition and security of attachment.

11. Inspect the cabin heating and ventilating system for leakage, condition of units, lines, and fittings. Check system operation by moving the controls to make certain they function properly.

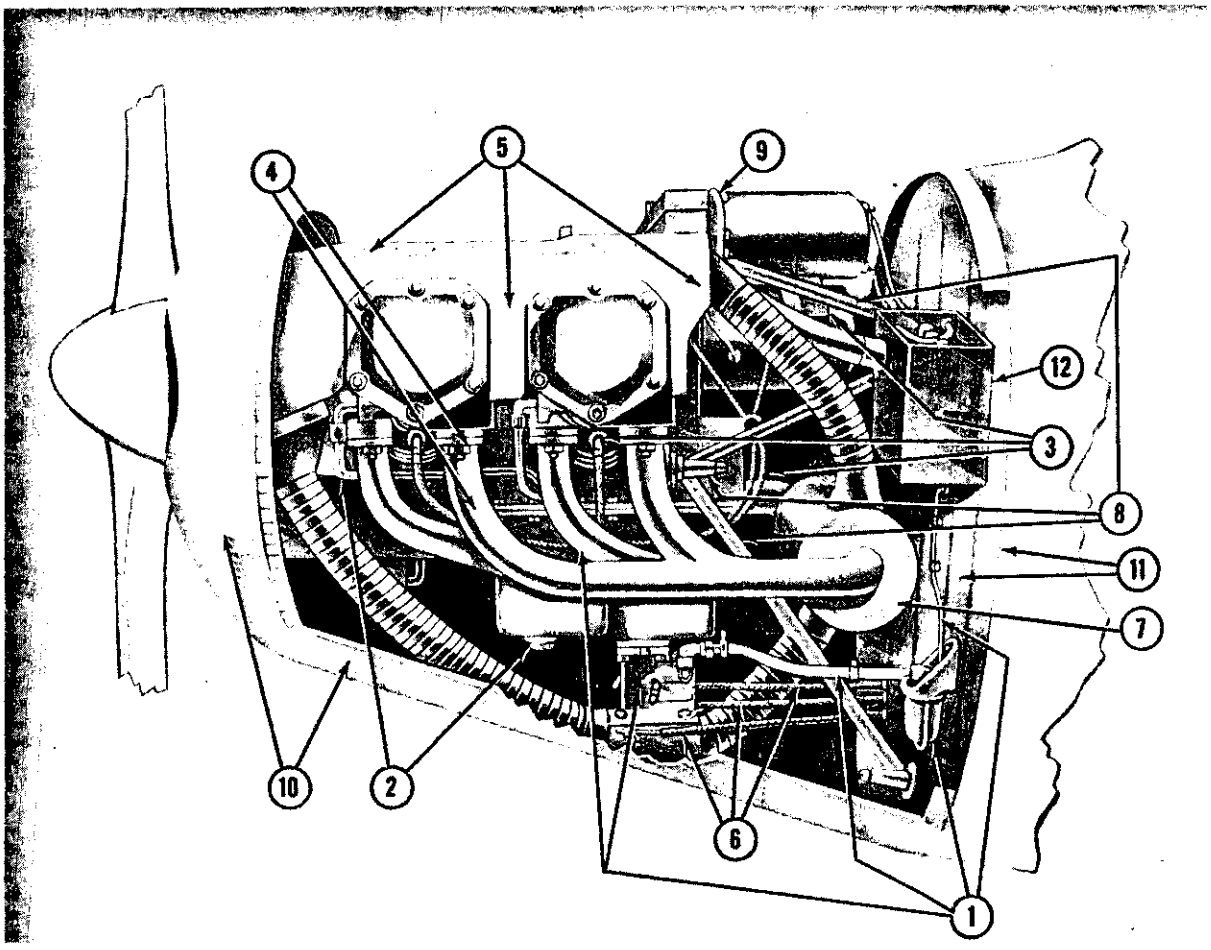
• Carefully observe that there are no fuel leaks in the system, if a gasoline type, and that no inflammable material is in the vicinity of the heaters and exhaust lines or ports.

12. Inspect all windows, windshields and canopies for cracks, discoloration, flaws, cleanliness, and freedom of operation.



Cracked and crazed windshield.

INSPECTION CHART — Engine—Nacelle



Fuel strainer checkpoints.

1. Remove, clean, and inspect the gascolator or main fuel strainer screens. Check for water and dirt contamination. Inspect bale wire bearing areas for excessive wear. Replace screens and safety.

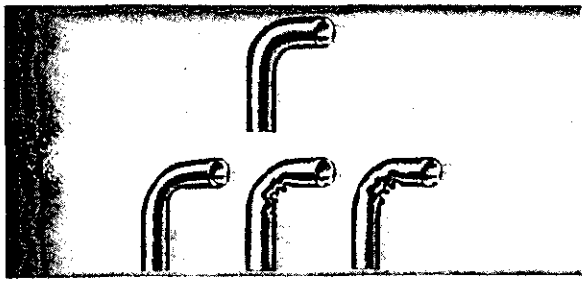
When reassembling the gascolator, care must be exercised in tightening the bale wire. Insufficient tightening may result in leakage; excessive pressures may damage the bowl. Be sure trapped air is eliminated to assure unrestricted fuel flow.

With fuel selector and boost pump on, inspect fuel lines and connections for leakage, cracks, kinks, chafing, and security of mounting. Examine hoses and clamps for tightness and condition. Assure that fuel lines do not interfere with adjacent equipment or lines.

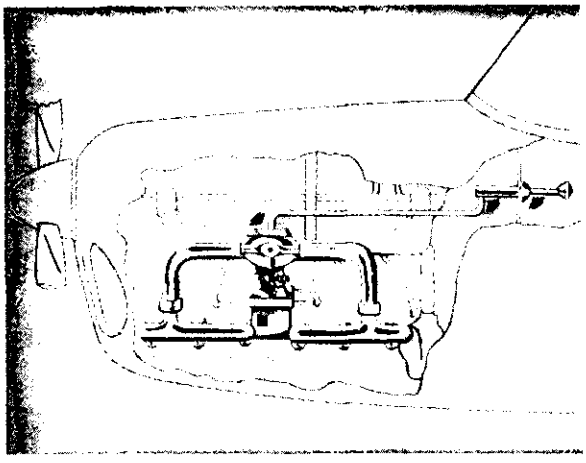
Examine the primer system for general condition and perform an operational check. Inspect for leakage and security of attachment. Assure that all connections are tight and that soldered joints have not separated.

• Copper primer lines should be annealed periodically to relieve brittleness. Annealing should be done only by qualified persons.

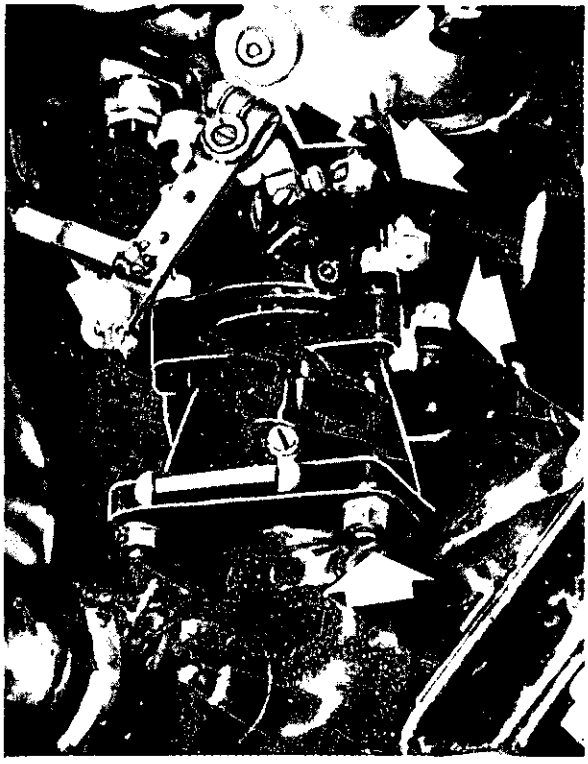
Inspect the carburetor for general condition, security of attachment, and for apparent or obvious defects. Inspect for excessive wear at throttle shaft, link assemblies, and hot air butterfly shaft bearing points, any one of which can affect the fuel–air mixture resulting in erratic engine operation. Inspect for leaks due to damaged gaskets, loose or damaged fuel line fittings. Drain carburetor bowl and examine the gasoline for presence of water or other contamination. Remove and clean carburetor screens and inspect for obvious damage. Flush carburetor by turning fuel supply on momentarily. Replace screens, drain plugs, and resafety.



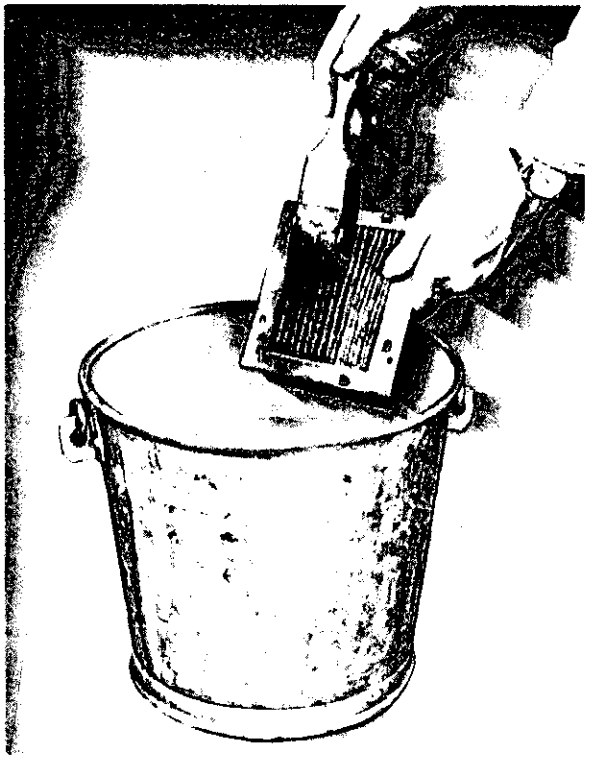
Tube bends (flattened and kinked).



Primer system inspection points.



Carburetor inspection points.



Cleaning carburetor air filter.

Intake manifold checkpoints.

When installed, remove carburetor air cleaner (filter) and clean in accordance with the manufacturer's instructions. Inspect air ducts for condition, satisfactory fit, and security of attachment. Reinstall filter.

Assure that the carburetor heater is properly secured and heater doors operate throughout their full range.

- If the carburetor heater doors do not operate throughout full travel, adjustment of the controls may be necessary.

Examine intake manifolds for general condition, cracks, kinks, and evidence of leakage. Assure that upper and lower packing nuts are tight and not leaking. If rubber hose is used, inspect for condition and security.

- If leaks around the packing nut cannot be corrected by tightening the nut, the packing gland will have to be replaced.

2. Inspect the oil tank, if a dry sump engine, for evidence of cracks or oil leaks, especially around welded seams and fittings. Leaks should be traced to their source and corrected.

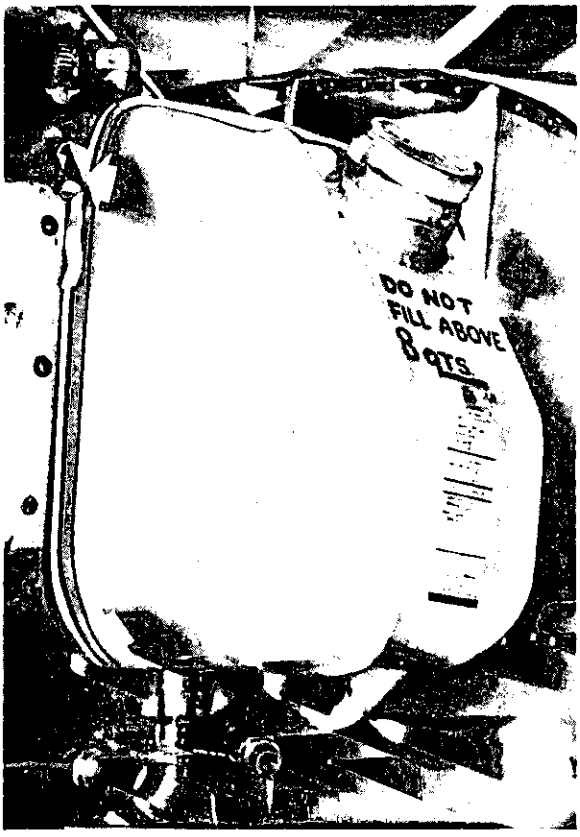
- Leaks in the oil tank will necessitate its removal and repair.

Oil tank inspection.

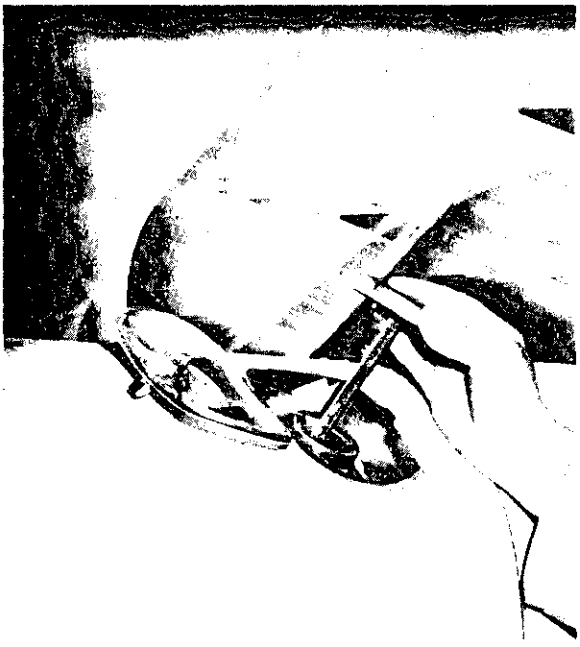
Check the oil tank for chafing at the adjustable retainer straps and for security of attachment.

• If chafing by straps is detected or if the tank has become loosened and cannot be tightened with the strap adjustment nuts, it may be necessary to replace the strap pads.

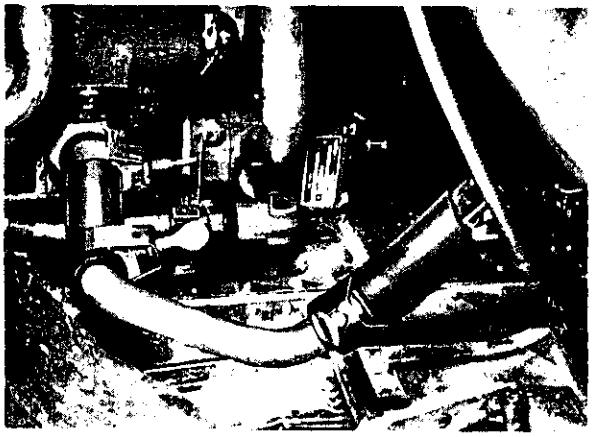
Be certain that sufficient oil is in the tank. When changing oil, drain oil through a screen or cloth to check for foreign particles. Assure that the new oil is as recommended by the manufacturer for the climatic conditions to be encountered.



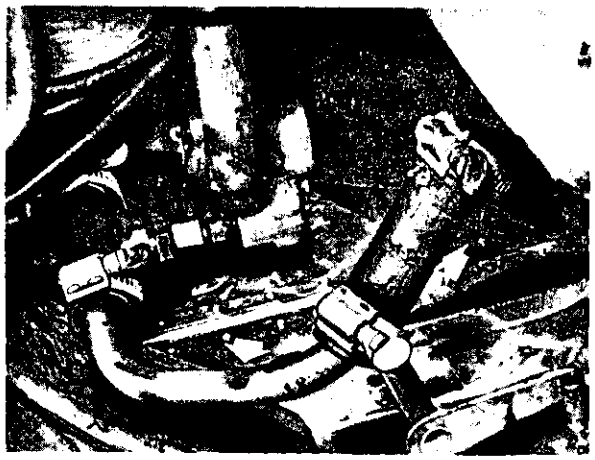
Tank retainer strap check.



Oil quantity check.



Satisfactory oil line installation.



Unsatisfactory oil line installation.

Inspect oil lines for leakage and security of attachment, particularly at connections. Oil hoses should be checked for condition and proper tension of clamps.

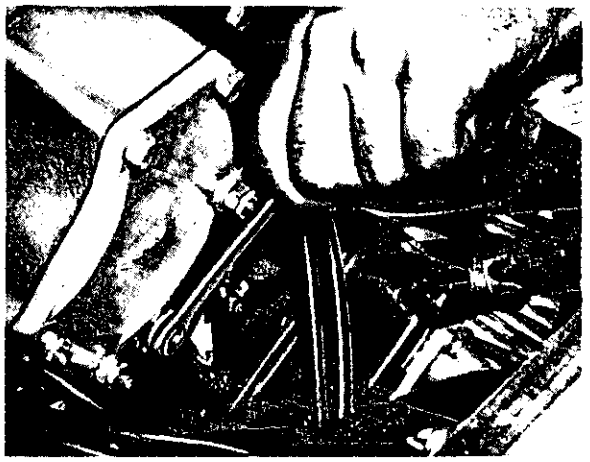
On wet sump engines, inspect sump for evidence of leaks. Remove oil sump plug and inspect for foreign particles. Remove, inspect, and clean oil sump strainers, noting condition. Reinstall drain plugs and strainers, and safety immediately. Refill the system with the proper type and grade of oil recommended by the manufacturer for the climatic conditions to be encountered.

• The presence of metal particles usually indicates an internal failure. It will be necessary to make a thorough internal inspection of the engine which, in most cases, results in a complete engine disassembly.

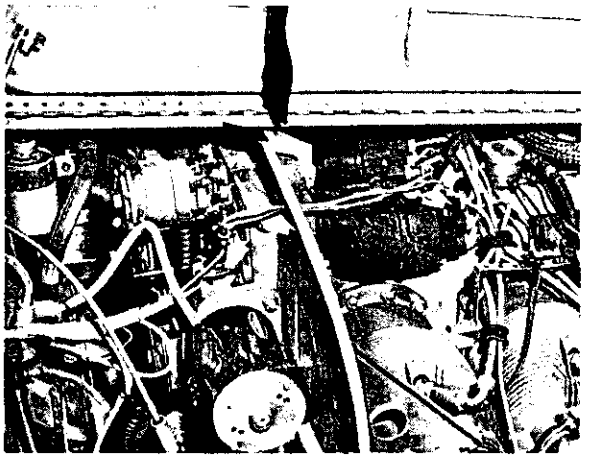
If the lubrication system incorporates an oil cooler or radiator, examine the unit very carefully for leaks, obvious defects and security of mounting.

Metal particles on oil sump screen.

Oil cooler inspection points.



Checking magneto security.



Magneto ground wire checkpoints.

• Any leaks or defects detected will require repair or replacement of the unit.

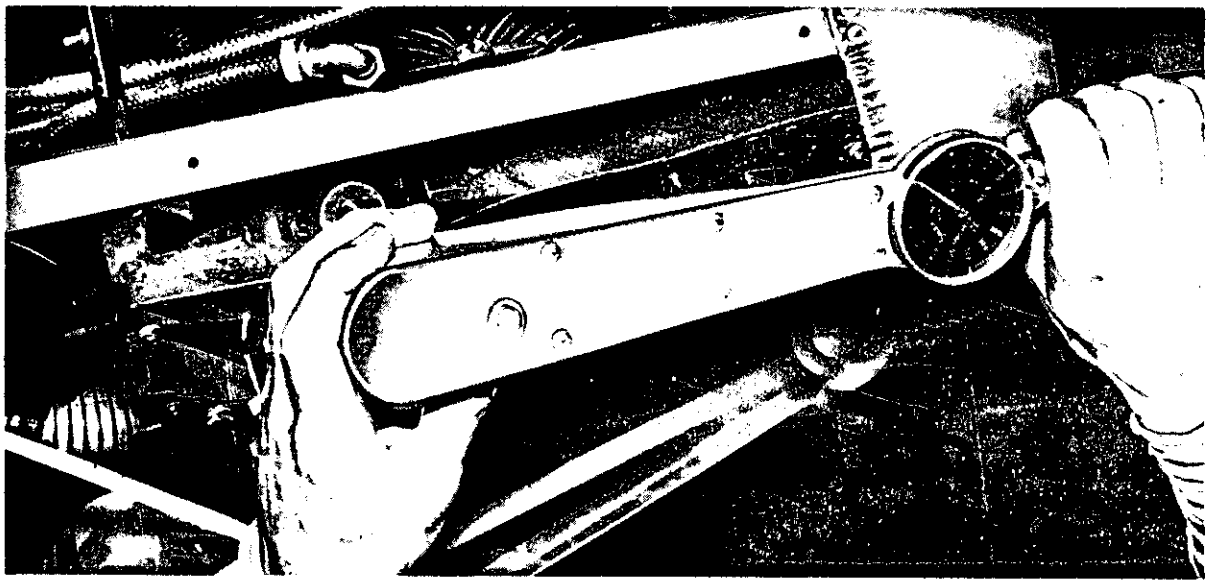
3. Be certain that the magneto holddown nuts are tight and properly safetied. Inspect magneto cover screws for security and tightness.

• If the holddown nuts are found to be excessively loose, it will be necessary to check the magneto timing to make sure that it has not been disturbed.

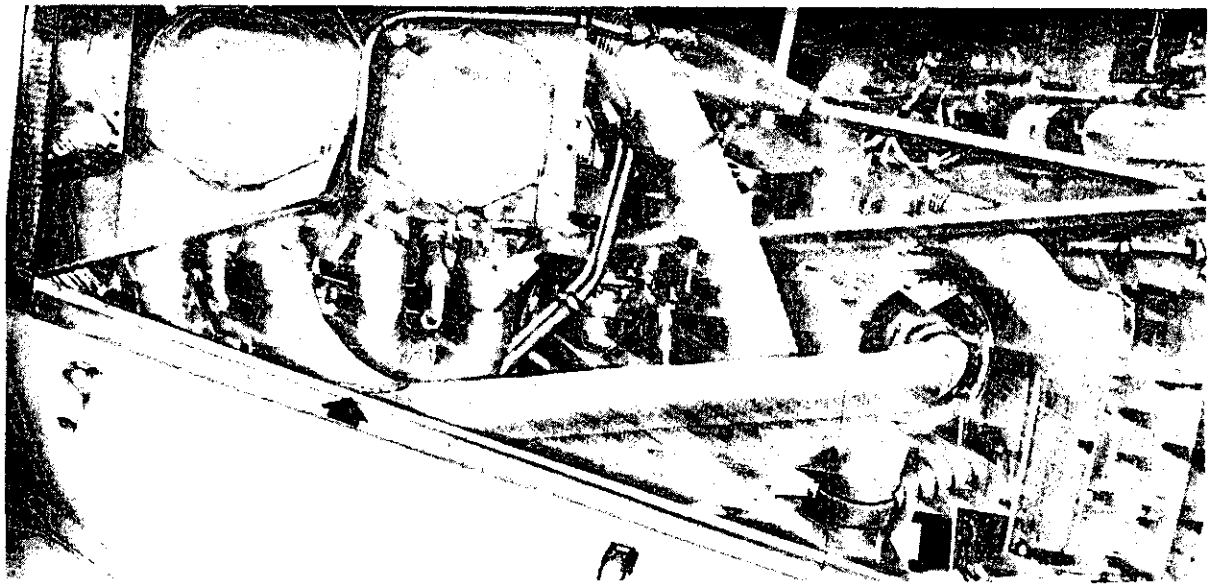
Examine ignition wiring and connections for general condition. Inspect spark plug barrels, elbows, and knurled nuts for proper tightness. Inspect shielding and bonding for condition and security. Check magneto ground wires for condition and proper attachment to the magneto terminal and the ignition switch. Periodically inspect spark plug "cigarettes" for cleanliness, cracks, and broken spring contacts.

• If the magneto is not properly grounded, it is possible for the engine to operate, even though the magneto switch is in the "OFF" position. *Beware of the propeller*, even when the switch is off—especially when the engine is warm.

Using a torque wrench, check the tightness of the spark plugs to the torque recommended by the manufacturer.

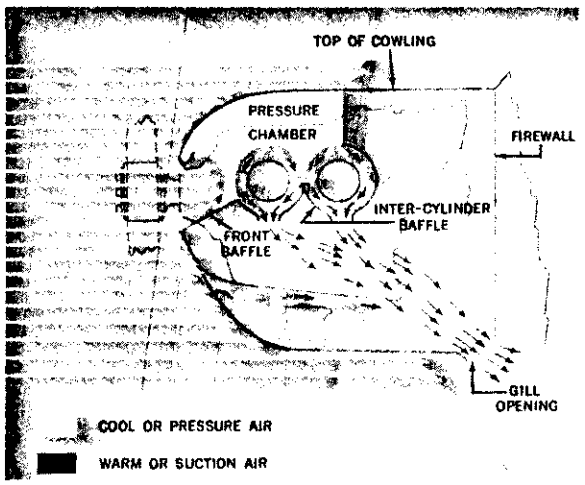


Torquing spark plugs.



Exhaust manifold inspection points.

Improperly secured and poorly welded exhaust manifold.



Airflow in pressure-type cooling system.

4. Inspect each exhaust stack for condition and security of attachment. If installed, examine entire collector ring or manifold for cracks, failure of the joints, or other indications of deterioration. Check that no portion of the engine cowling has been in contact with or is wearing on the collector ring or stacks. Be certain that all support bolts are tight and safetied.

• Inspection of the engine exhaust system should be thorough to assure there are no defects that might permit an open flame to enter the engine compartment and thus present a fire hazard.

5. Inspect coolant radiator, if installed, for security of attachment, leaks, condition and security of lines, tension of hose clamps, and condition of fittings and connections.

• If cooling system appears to contain excessive rust or other contamination, the system should be drained, flushed, and refilled with the proper coolant.

Inspect engine cylinders for cracked or broken fins. Check baffles for security, holes, cracks, and proper fit around the cylinders. Inspect all air entrances and exits for deforma-

Cowl flap inspection items.

tions which might obstruct airflow. Using a flashlight, look through the nose cowling and check for gaps between the top cowling and engine baffles.

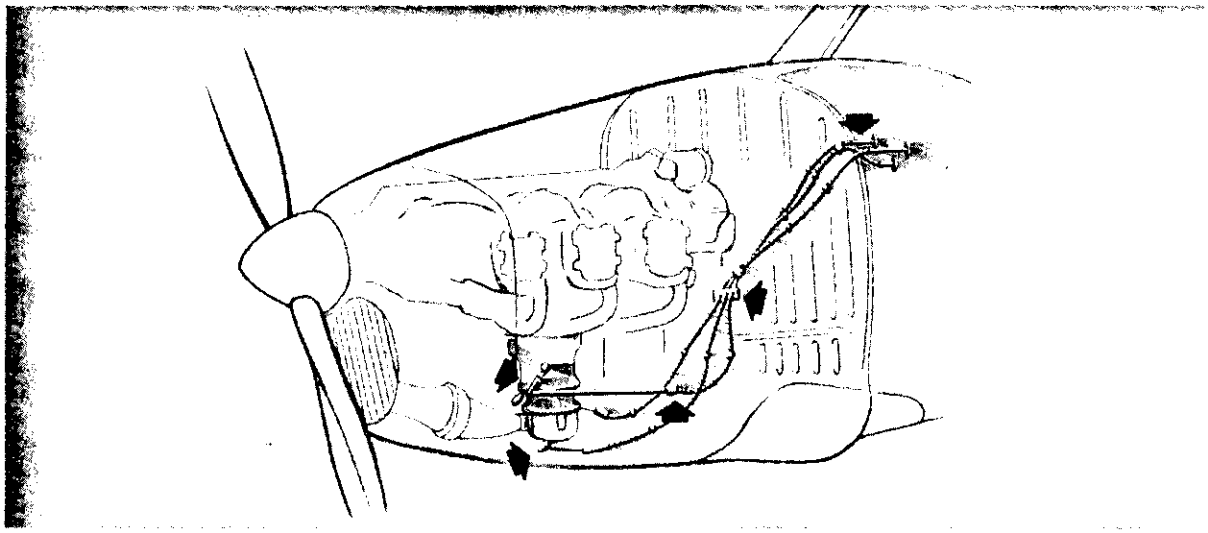
• Since most air-cooled engines require pressurized air for cooling, any leak around or through the baffles causes a pressure drop and consequently reduces the cooling efficiency of the engine.

If installed, determine that cowl flaps are in good condition, that hinges are not excessively worn, and that the actuating mechanism is properly rigged for full travel and operating properly.

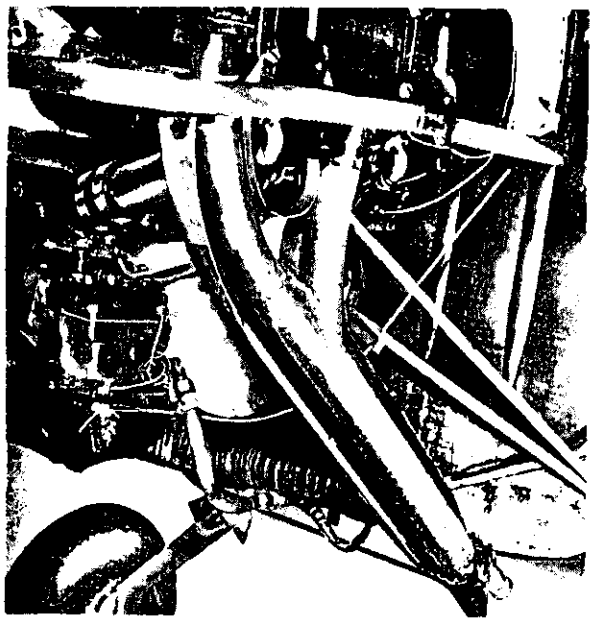
• Operation of the cowl flaps is of vital importance in keeping cylinder head temperatures within the required operating range. They must be maintained in good operating condition at all times in order that required engine efficiency may be obtained.

6. Examine throttle, mixture, and carburetor air heater controls for excessive play in the linkage. Check operation throughout full range of travel. Inspect push–pull controls for defects, security of end fittings, proper safetying and for slippage or movement inside the mounting clamps.

• Any binding or malfunctioning of the engine control system should be traced to its source and corrected.



Sample engine control system inspection.



Acceptable exhaust manifold with shroud removed.

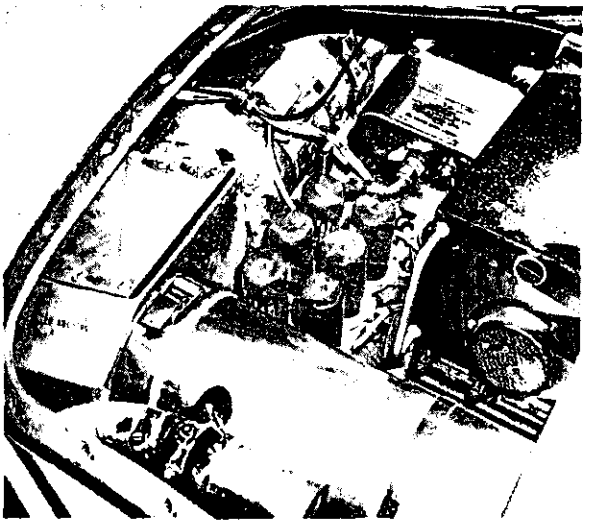
Unacceptable exhaust manifold (cracked).

7. Remove the heater shroud from exhaust manifold and/or muffler and inspect the manifold for cracks, burned-out spots, or defective welds. Determine that shutoff valves are operating through their full travel, cold air and heater ducts are free of obstructions and cracks and are properly secured. If the heater incorporates an intensifier tube inside the exhaust ring or manifold, it should be removed and inspected for cracks or burned-out spots.

• Defects noted in the heater system must be repaired or the unit replaced immediately to assure that carbon monoxide or flames will not enter the cabin or cockpit. Exhaust or heater system leaks may result in headaches and/or nausea. When a leak is indicated or suspected during flight, open cabin windows; turn the cabin heat "OFF" and fresh air ventilation "ON" to avoid carbon monoxide poisoning.

When combustion heaters are installed, inspect for security of mounting and proper installation of hot and cold air intake ducts. Inspect fuel lines for condition, leaks, attachment, and freedom from obstructions and kinks.

• With heater switch "ON," check the solenoid valve to determine whether or not it is operating satisfactorily. If no clicking can be heard in the solenoid, it should be removed, cleaned, and inspected. Assure that exhaust and overflow lines are properly routed through the structure to the outside air.



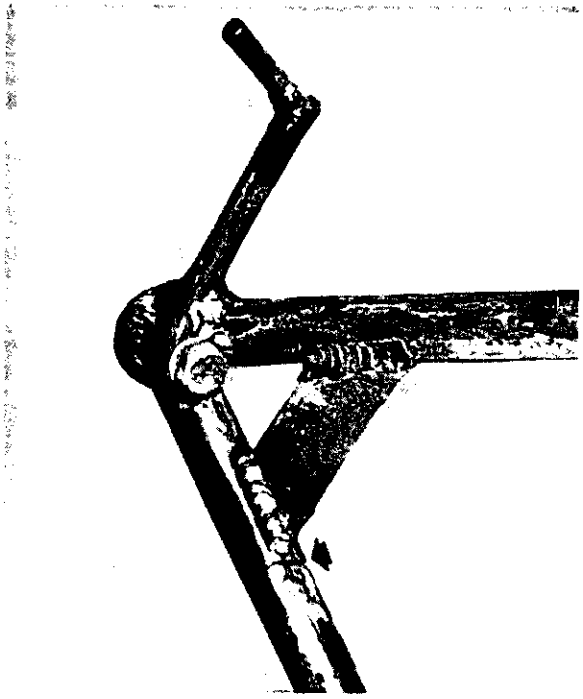
Combustion heater checkpoints.

8. Examine (with a magnifying glass) the entire engine mount structure, especially at welds, for evidence of cracks or failure and inferior welds. Assure that all attachment bolts are tight and properly safetied.

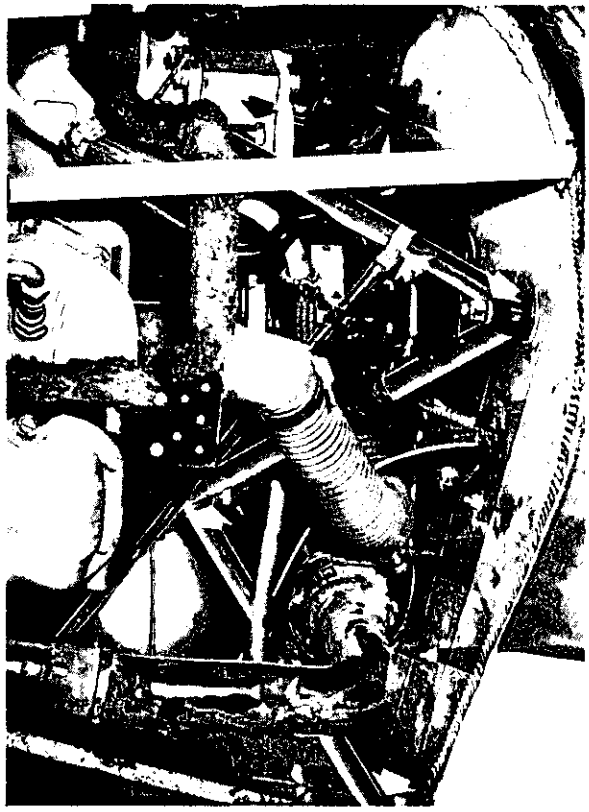
• Some engine mounts are heat-treated units and may not be repaired by welding unless normalized and reheat-treated to their previous strength values. When cracks or inferior welds are found in such units, replacement or repair by the manufacturer or authorized repair facility may be necessary. Nonheat-treated items may be repaired if work is performed in accordance with pertinent Federal Aviation Agency publications or as recommended by the manufacturer.

9. Inspect the mounting of all accessories, such as generator, starter, oil pump, oil pressure relief valve body, etc., for security of attachment, oil leakage, and proper safetying.

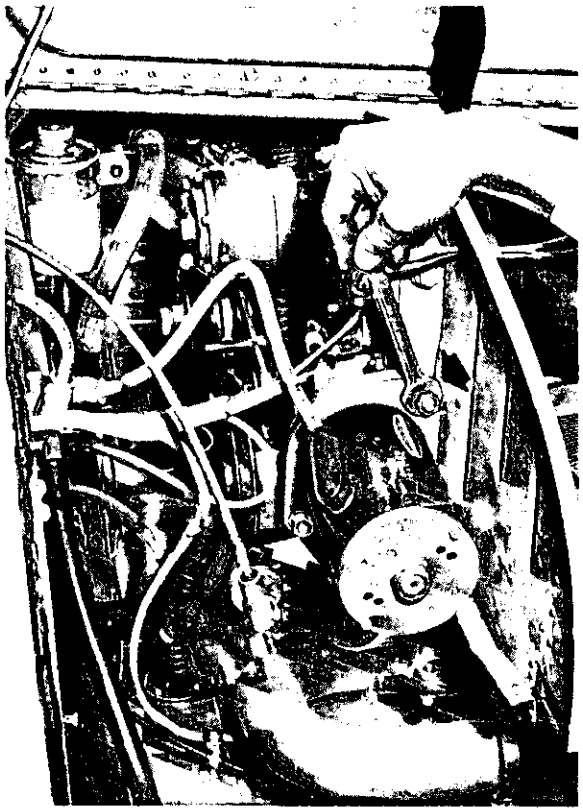
• If oil or other fluid leakage is detected around any of the accessories, the leaking unit should be removed and the leakage corrected.



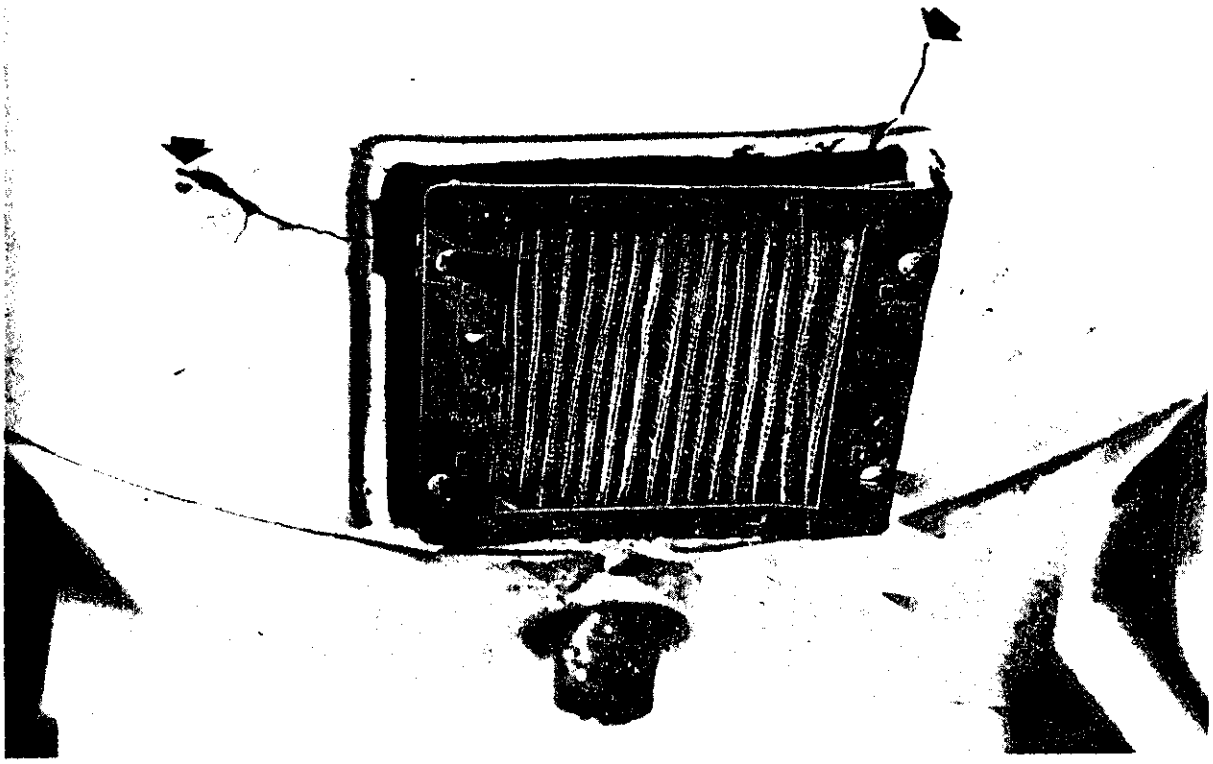
Cracked engine mount.



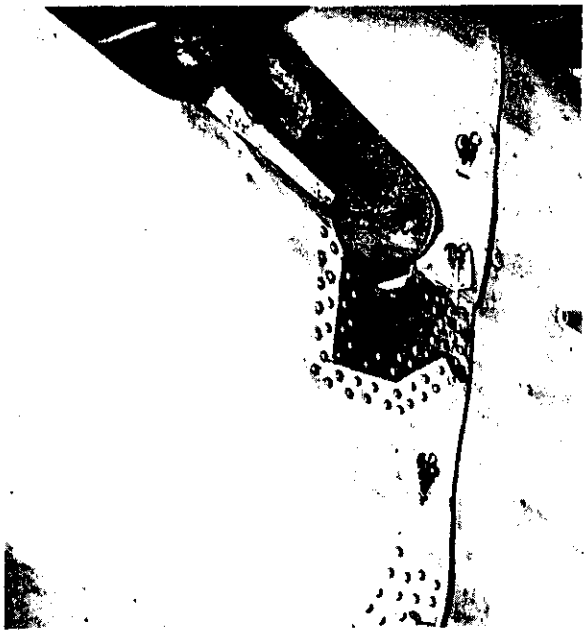
Typical engine mount checkpoint.



Checking security of starter.



Cracked cowling.



Repaired cowling.

10. Inspect engine cowling for apparent or obvious defects such as cracks, dents, chafing on portions of the engine or aircraft structure, loose rivets, clamps, fasteners, and other locking devices.

• The presence of black or dark streaks on aluminum structure usually indicates chafing caused by vibration and looseness.

If there are no defects, or after noted defects have been corrected, reinstall cowling and check for proper fit and security of attachment.

11. Check condition of the firewall behind the engine. Inspect insulation for condition, attachment, and for oil or fuel saturation.

• Oil or fuel saturation of insulation material presents a serious fire hazard.

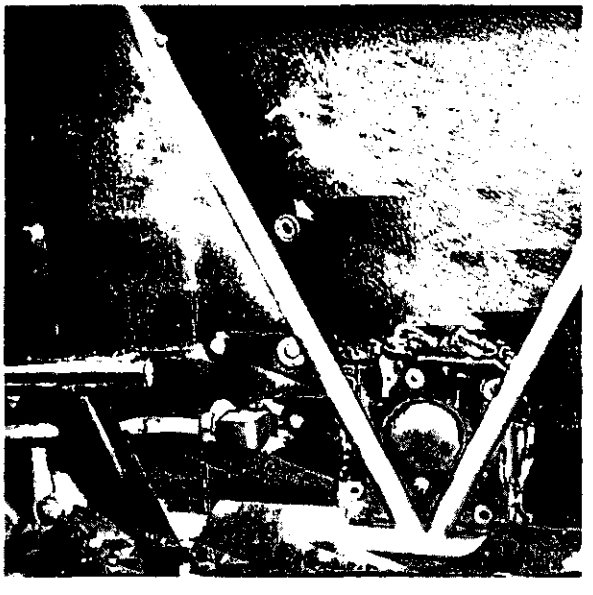
12. Check battery box and terminals for corrosion and security. Inspect vents and overflow lines for condition and obstructions. These lines should be routed to prevent overflowing liquid from contacting and corroding adjacent

Checking cowl latches.

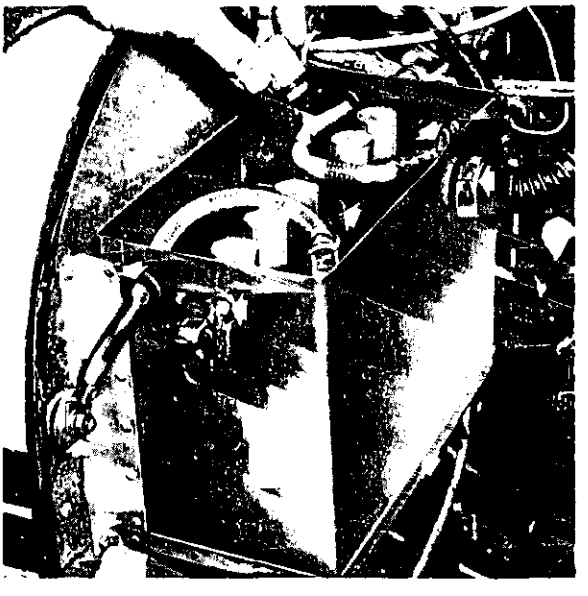
structure. Examine the electrolyte level and, using a hydrometer, determine the charge of the battery. When the hydrometer test indicates a variance of more than 20 points between cells the battery should be recharged or replaced.

• If the electrolyte level is low, replenish with distilled water to specified level. A 30-minute flight should be a sufficient operating time before conducting a hydrometer test after refilling.

It is good practice to protect the area adjacent to the battery with an acidproof paint. When working around the battery, care should be exercised to avoid short-circuiting across the terminals. Resultant arcing presents a serious fire hazard. As a safety precaution, the battery should be removed during cleaning and repair operations, removing the "ground" terminal first.



Firewall insulation checkpoints.



Battery checkpoints.

Section 4. LANDING GEAR

There are numerous types of landing gears: tripod, spring steel, single strut, and retracting gear for operation on wheels from prepared or semiprepared hard surfaces; float gear for operation from water; and ski gear for operation from snow and ice surfaces. Certain items are common to nearly all wheel-type landing gear and, therefore, will be discussed as one topic to simplify the inspection procedure.

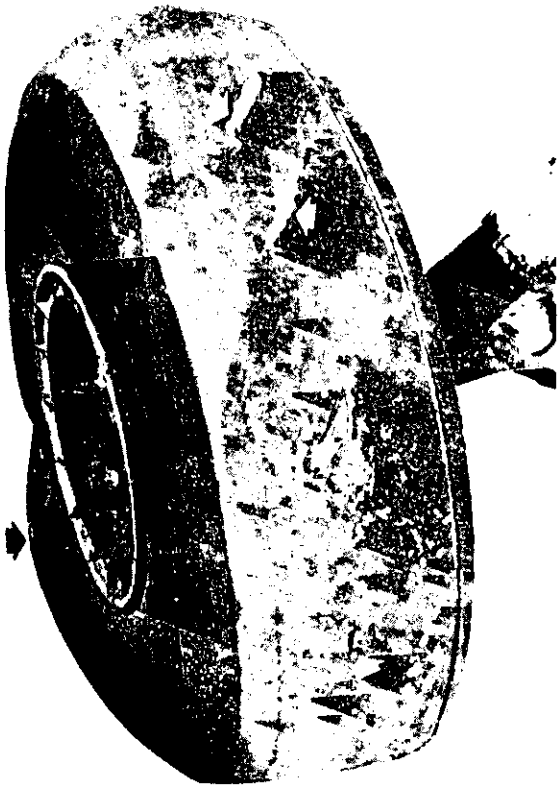
Tires

Inspect tires for proper inflation, that is, the pressure recommended by the aircraft manufacturer. Look for cuts, bruises, wear, bulges, foreign objects imbedded in the tires, and deterioration.

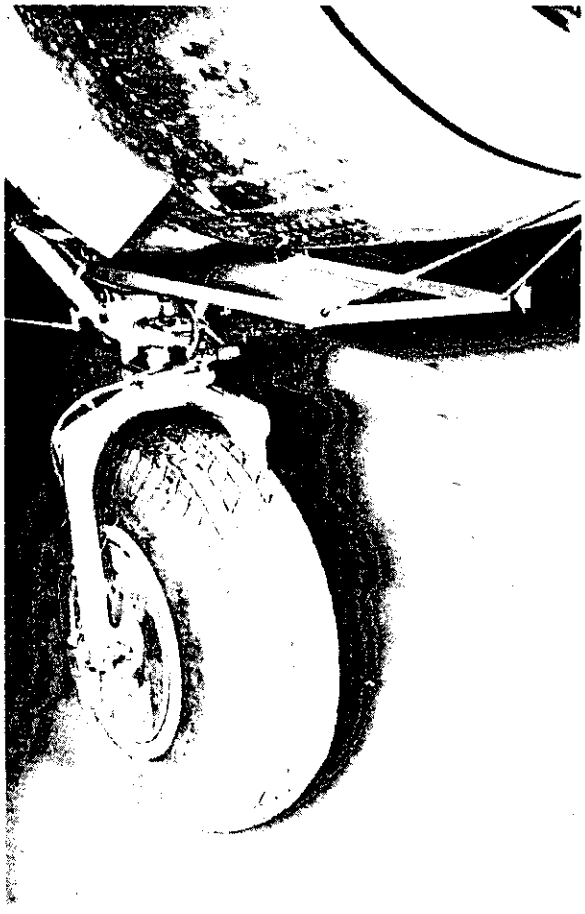
- Excessive wear of tires may be caused by misalignment of landing gear (wheels, scissors assembly, or axles). If tires are under-inflated, their sidewalls may crack and show other signs of excessive breakdown. If tubeless tires are under-inflated, the seal against the rim may leak. Over-inflated tires may show abnormal crown wear.
- Unbalanced wheels result in uneven tire wear and cause vibration which can, in turn, damage other parts of the aircraft.

Some tires have a color tracer or color thread imbedded in the carcass. When the tire wears to a certain point, the color tracer indicates that it is time to recap, retread, or replace the tire. If the tire has no color tracer, a tread worn smooth is a signal for similar action.

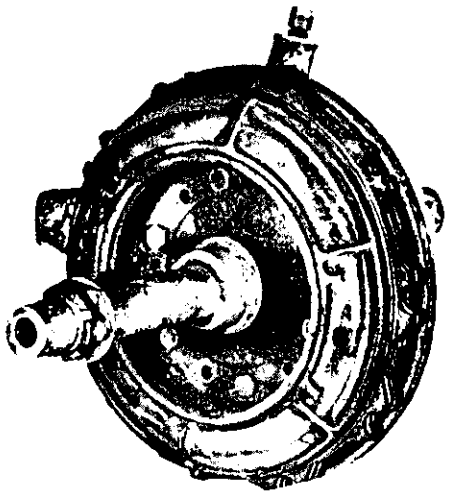
- Gasoline and oil can cause rapid deterioration of rubber in a tire. Do not allow oil or gasoline to drip on tires. Avoid parking the aircraft in an accumulation of gasoline or oil.



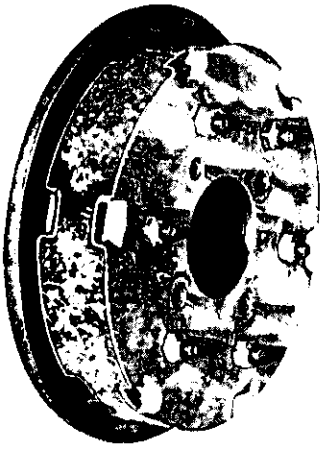
Examples of tire defects.



Tire protected by oil drip pan.



Multiple disc-type brake.



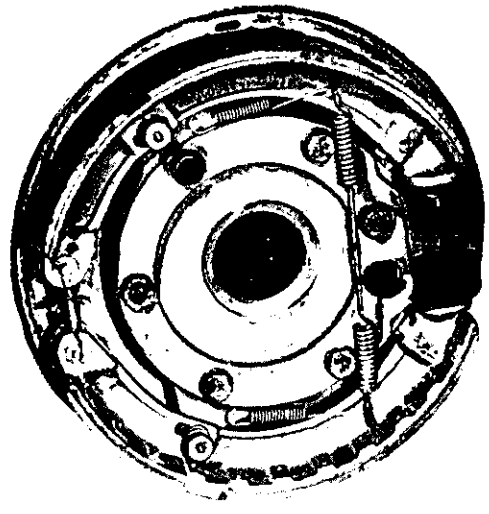
Expander block-type brake.

Brakes

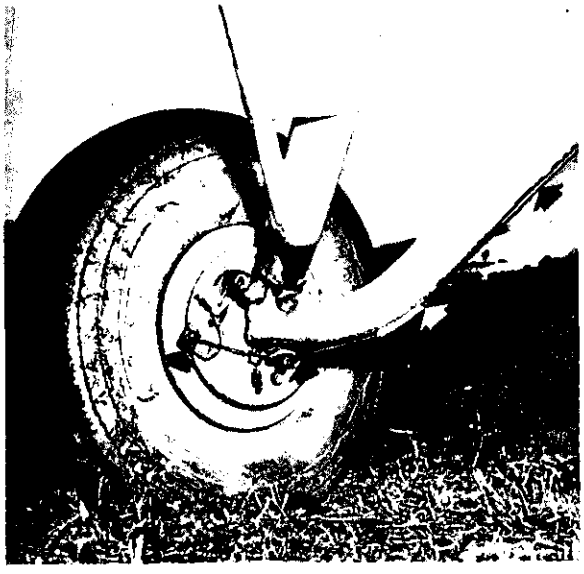
Jack up the airplane, remove the wheel and inspect the brake assembly for broken or distorted parts, broken springs, and worn lining. Faulty or missing spring clips may cause brakes to chatter. Check condition of friction components (discs, expanders, and shoes). Examine brakes for security of nuts, bolts, and cotter pins. Determine that foot and parking brake controls are in good condition, operating properly, and safetied.

• Improper function of brakes could cause serious consequences. Any defects noted should be referred to qualified maintenance personnel for repairs or adjustment.

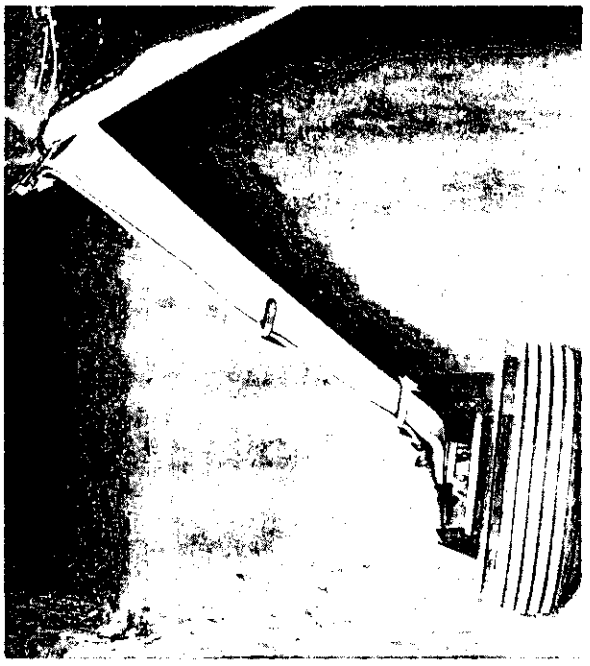
When mechanical brakes are installed, examine the cables for fraying. Check pulleys for ease of turning, alignment, and broken attachments. Inspect actuating arms for proper bearing and throw. Check pedals for proper operation.



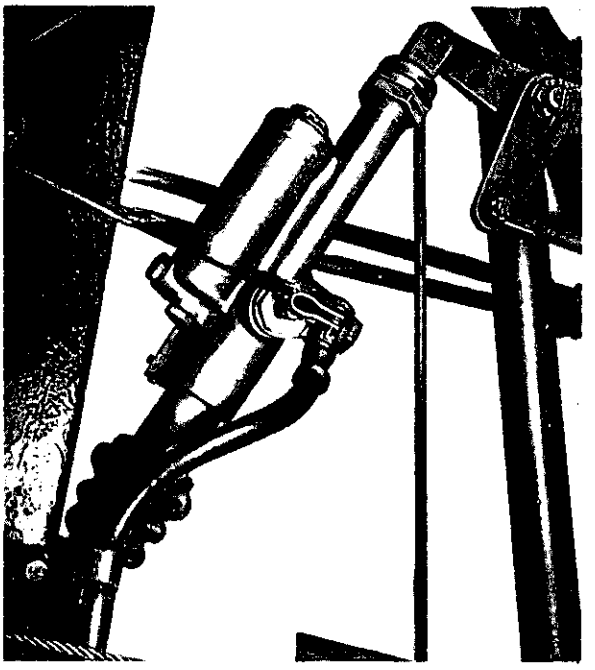
Shoe and drum-type brake.



Mechanical brake cable routing.

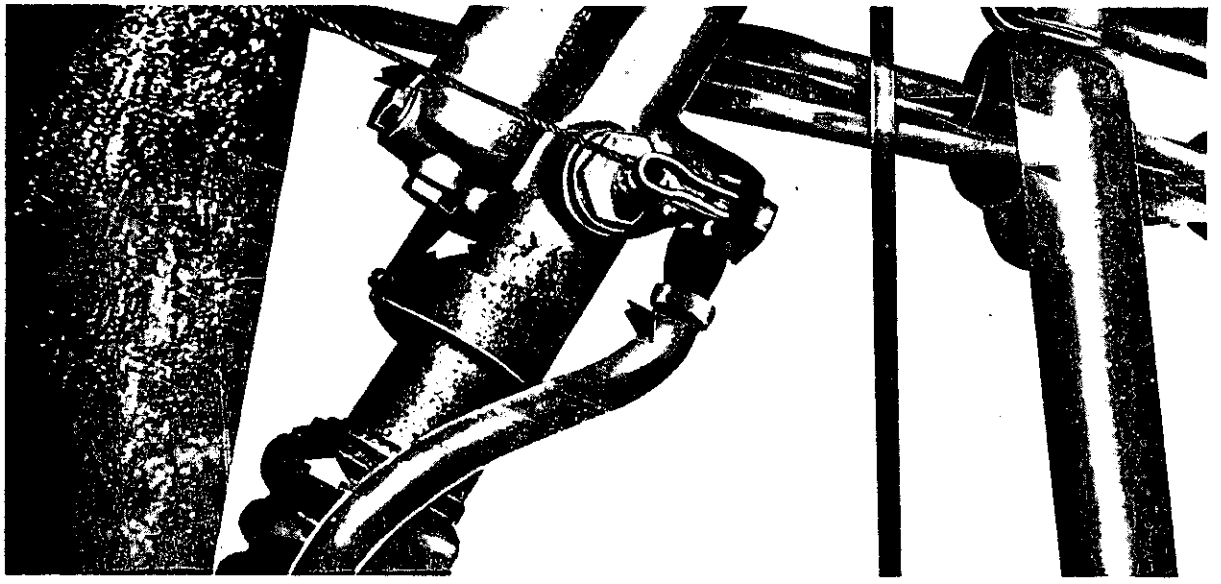


Hydraulic brake line checkpoints.

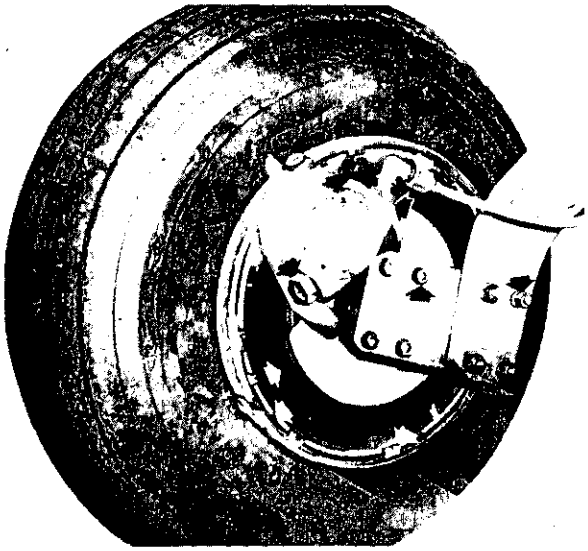


Normal brake cylinder.

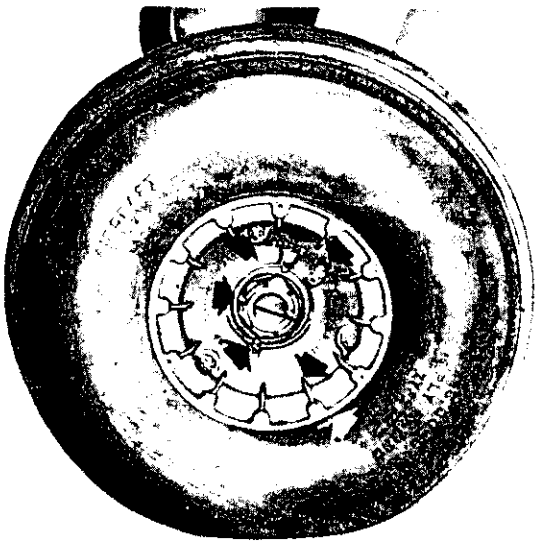
When hydraulic brakes are installed, inspect fluid lines for damage or obvious defects. Check the system for leakage around wheel, master cylinders, and connections. Inspect for deterioration and security of flexible tubing. Check brake fluid level in the reservoir. A low fluid level may indicate a leak somewhere in the system, requiring a more thorough inspection of the brake system. Use the type of brake fluid recommended by the aircraft manufacturer. A "spongy" pedal may indicate air in the brake system or other abnormal condition requiring further inspection and corrective action.



Leaking brake cylinder.



Wheel installation and brake inspection points.

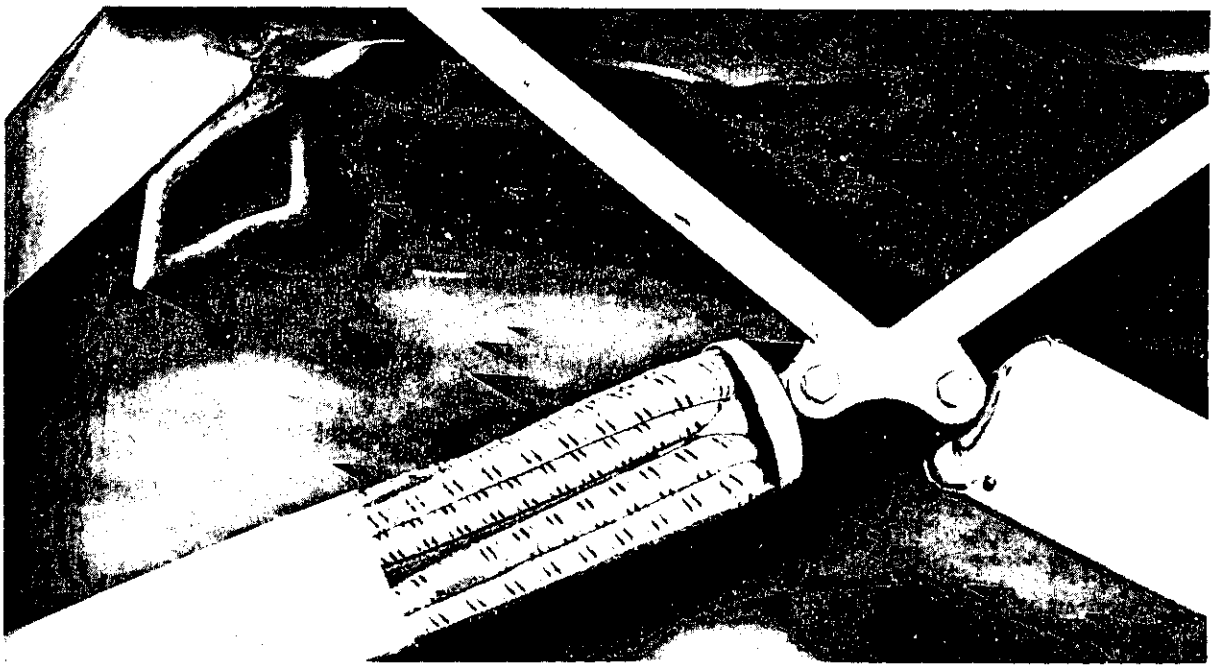


Wheel checkpoints.

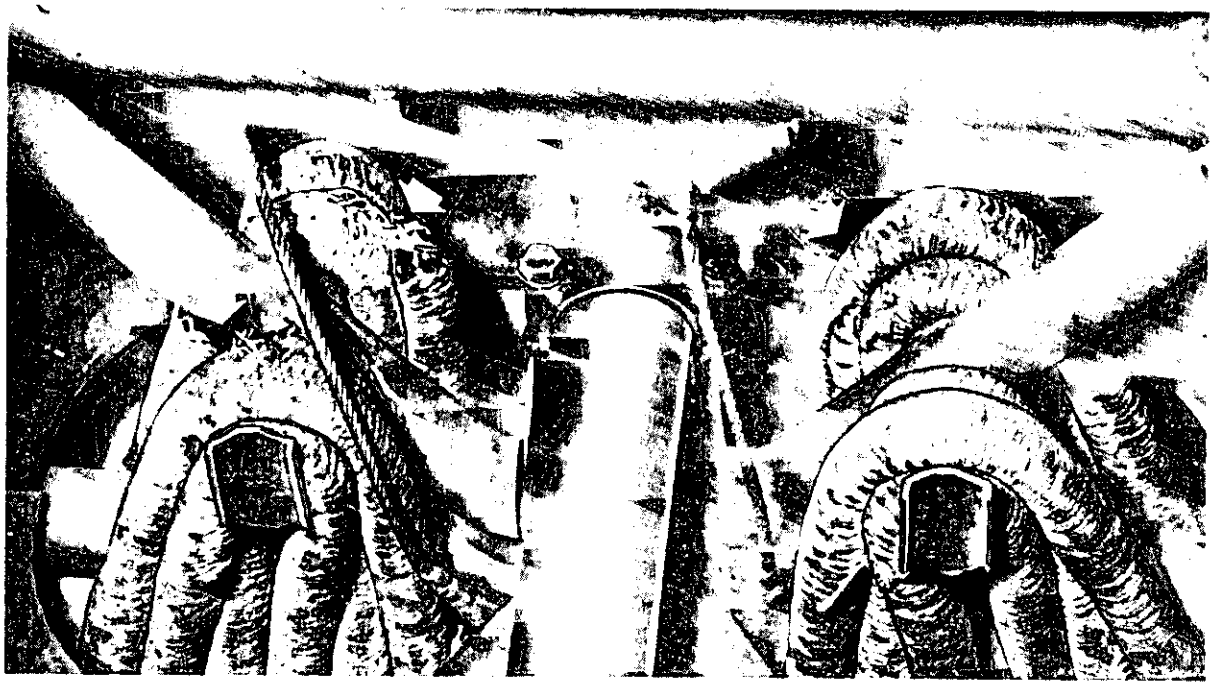
Wheels

Inspect wheels for damage and cracks. A bent or distorted wheel flange generally indicates that it is cracked or broken. Inspect bolts for condition and security of attachment. Before reinstalling wheels, clean and check condition of wheel bearings and lubricate. With the wheel installed on the axle and adjusted, check for excessive side play by movthe wheel back and forth against the thrust washer and adjusting nut. When properly adjusted, safety the retaining nut.

To prevent damage to bearings from the abrasive action of dirt, hub caps should be installed and secured in position.



Shock cord.



Worn, frayed, and broken shock cords.

Shock absorbers

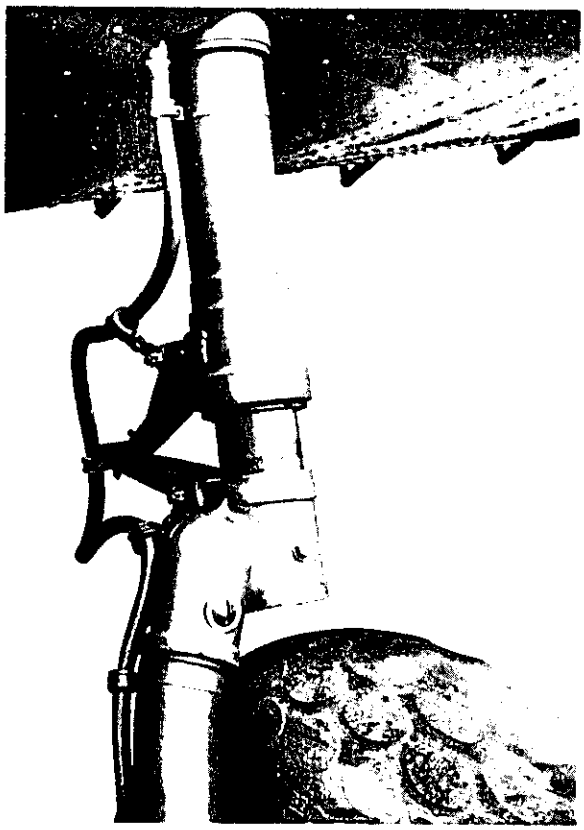
Regardless of the type of landing gear installed, a shock absorbing mechanism is provided to absorb the landing loads. A number of different shock absorbing devices are used by aircraft manufacturers, a few of which will be discussed here.

When shock cords are employed, inspect for general condition, cleanliness, stretching, and fraying. Shock cords must be kept free from accumulations of gasoline and oil, both of which deteriorate rubber products.

Generally, spring steel-type shock absorbers require little, if any, maintenance; however, a careful examination should be made for cracks in the area where the attachment brackets are riveted to the fuselage and attach to the unit. Inspect for apparent or obvious defects and security of attachment.

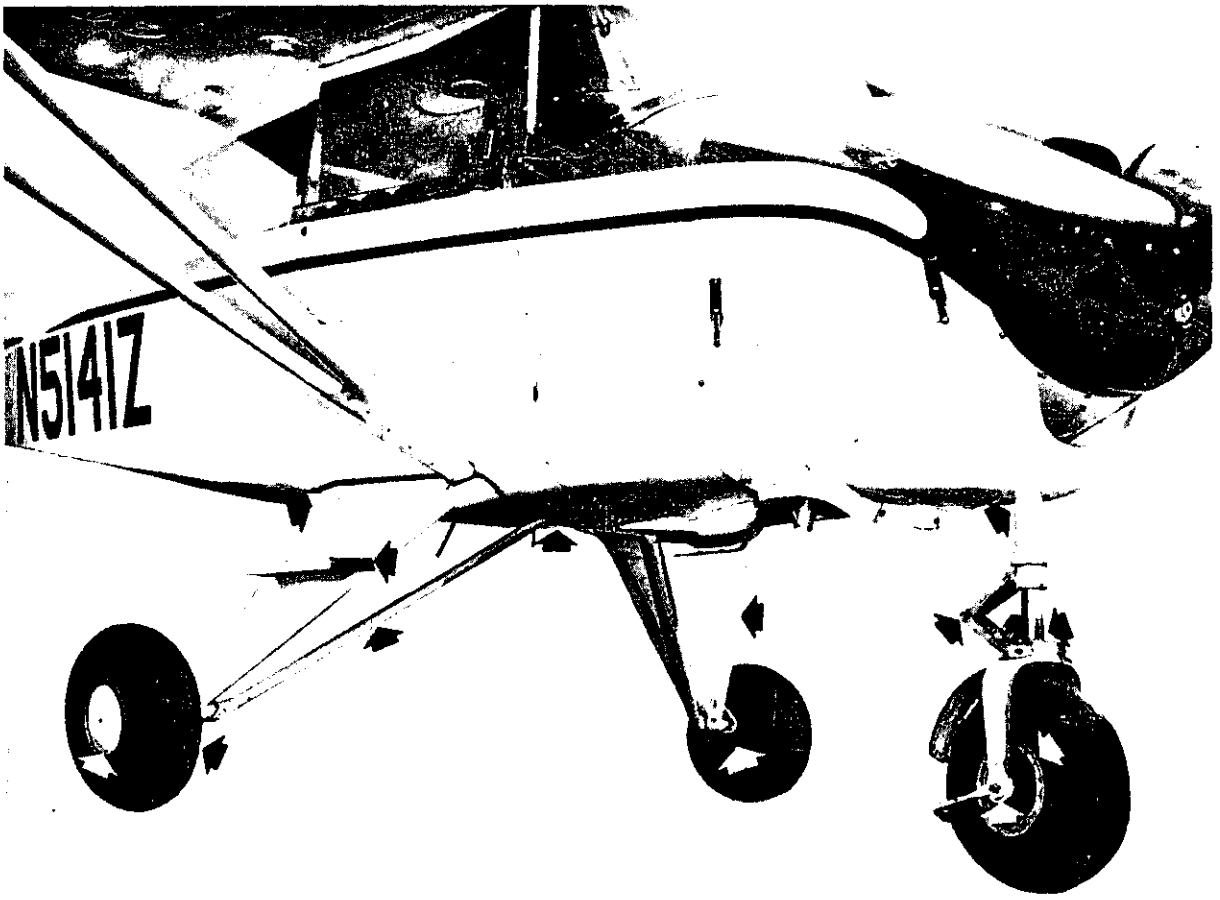
Inspect oleo-type shock absorbers for cleanliness, leaks, cracks, and possible bottoming of the pistons. Check all bearings, bolts, and fittings for condition, lubrication, and proper safetying.

- Follow the manufacturer's instructions when replenishing fluid and pressure charge in the shock absorber.



Oleo-type landing gear inspection points.

INSPECTION CHART — Fixed Landing Gear



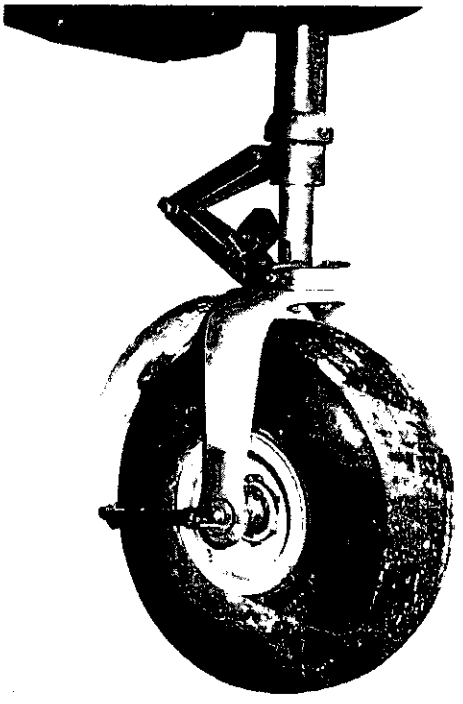
Perform a close visual inspection of the main landing gear for cracks in the vicinity of welds. Examine attachment fittings for condition and elongation of bolt holes.

• Wrinkled fabric or metal skin detected in the area of the attachment fittings should be referred to a qualified mechanic for a detailed inspection and analysis.

Inspect struts for cracks, bowing, and security of attachment. Check braces and fittings for general condition and possible defects.

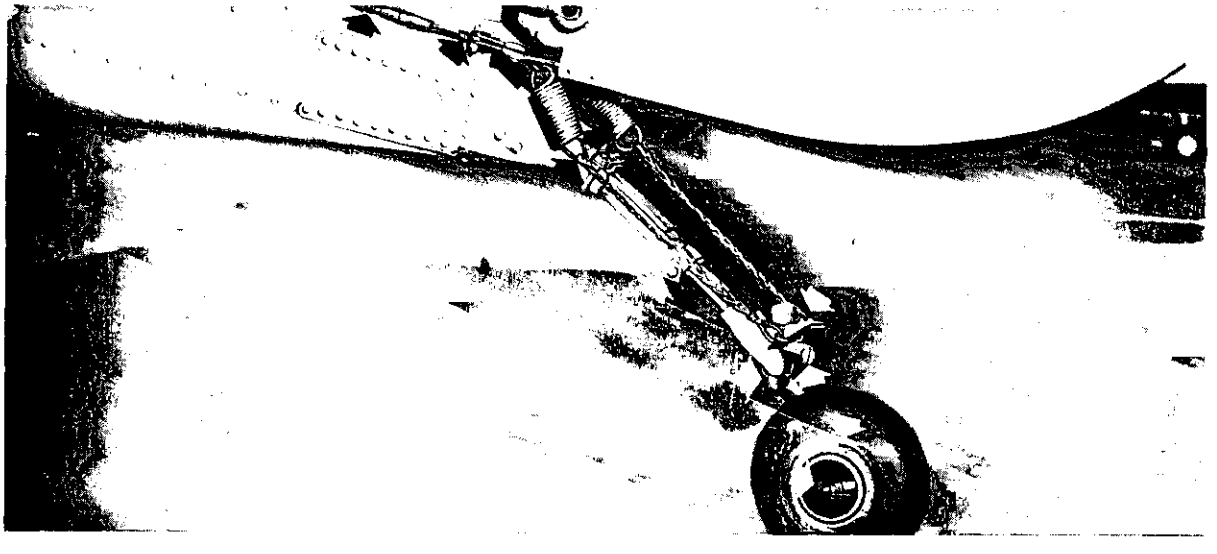
Excessive play between fittings may be more readily detected if the wheel is off the ground and the landing gear vigorously shaken in a fore and aft direction, as well as up and down. If noticeable clearance is detected at any of the attaching points, the bolts should be removed and inspected for wear or distortion. Defective bolts should be replaced immediately and distorted bushings and fittings repaired or replaced as recommended by the manufacturer. Since there will be considerable movement at the bearing surfaces, it is essential that they be inspected carefully and properly lubricated at frequent intervals.

Inspect the nosewheel assembly for general condition and security of attachment. Examine linkage, trusses, and members for evidence of undue wear or distortion. Ensure that all bolts, studs, and nuts are secure with no indication of excessive wear and are properly safetied. If a shimmy damper is installed ensure that it is operating satisfactorily and the steering mechanism is properly rigged.



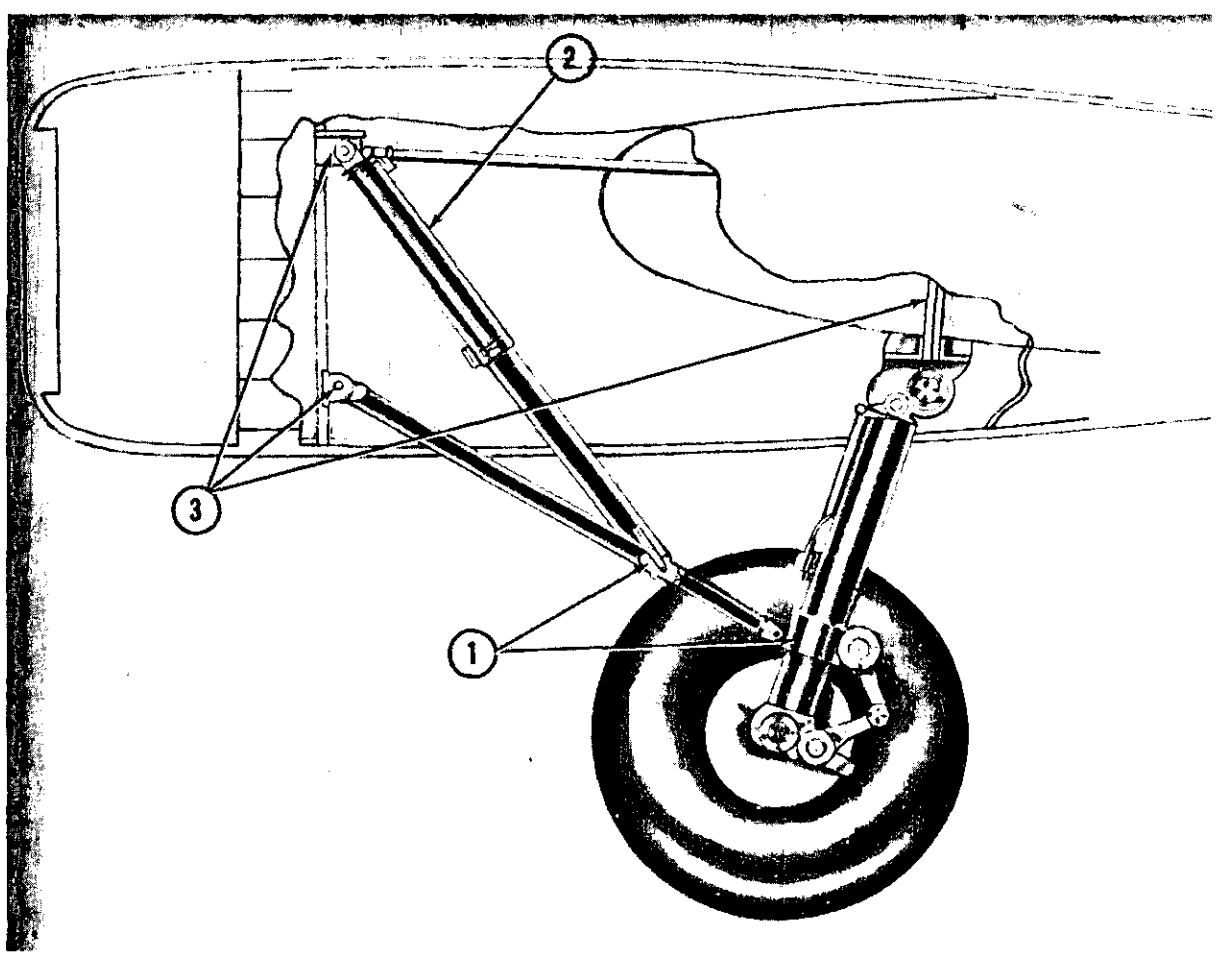
Fixed nose gear.

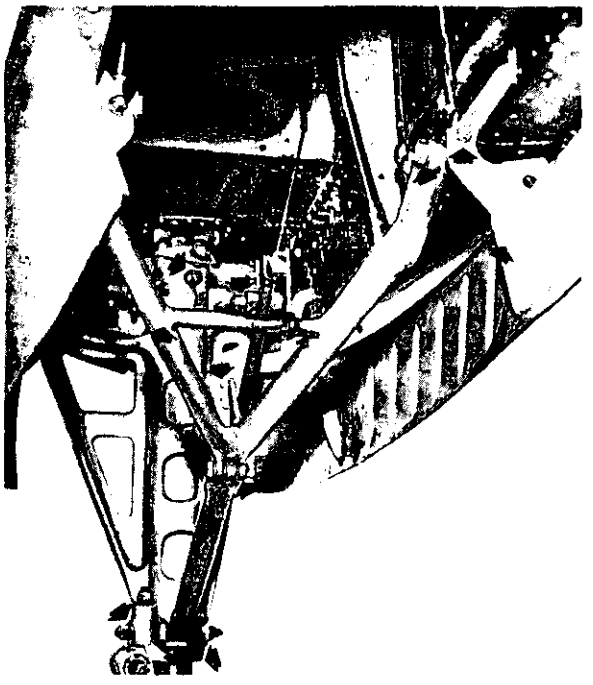
Steerable tailwheels should be inspected for bearing adjustment, lubrication, clearance, and range of operation. Check for proper steering action and security of attachment.



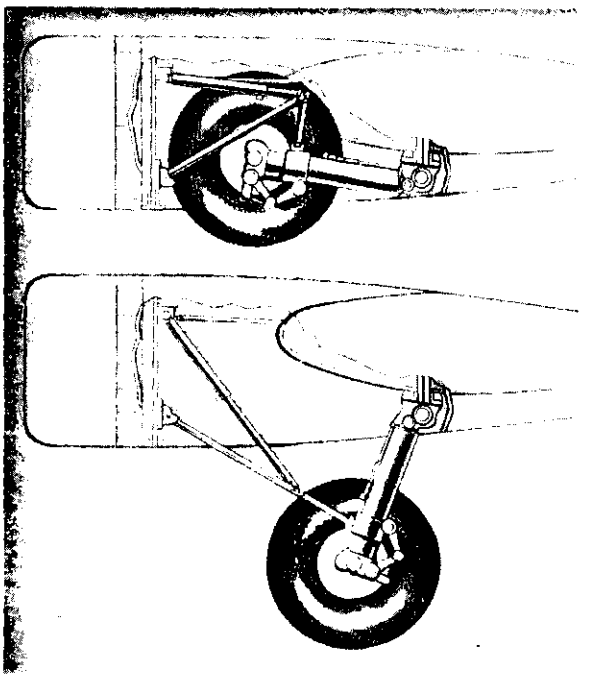
Steerable tailwheel inspection points.

INSPECTION CHART — Retractable Landing Gear





Retractable landing gear checkpoints.



Landing gear retracted and extended.

1. Landing gear that retract into the wing, nacelle, or fuselage structure should be checked frequently for defects and proper operation. Particular attention should be given to locking mechanisms, drag struts, shock struts, stops, linkages, and alignment. Be sure the shock strut is properly inflated and the piston is clean and oiled. Examine fairing doors for satisfactory operation, proper rigging, and for loose or broken hinges.

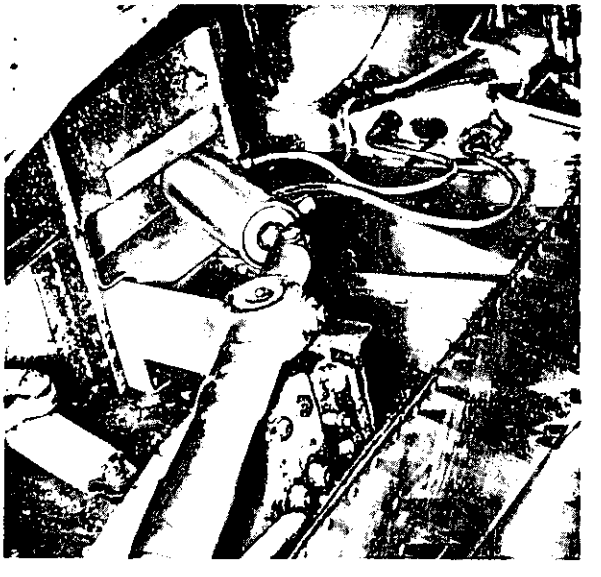
• When new or retread tires are installed, a gear retraction should be performed to check for proper clearance. Improper tire size may cause the gear to hang up in the wheel well.

2. Check nose/tailwheel and main gear uplatches for general condition and proper operation of the entire latch assemblies. Inspect the down-lock mechanism and power source for general condition.

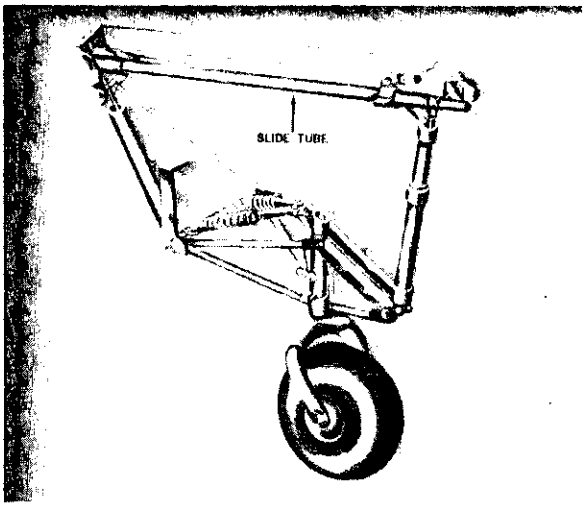
• For proper lubrication and inspection of retractable landing gear, refer to the manufacturer's service instructions.

Inspect retracting and extending mechanism of the nose/tailwheel and main landing gear for general condition, defects, and security of attachment. Determine that actuating cylinders, sprockets, universals, and chain or drive gears are in good condition and within the manufacturer's tolerances. Lubricate as required.

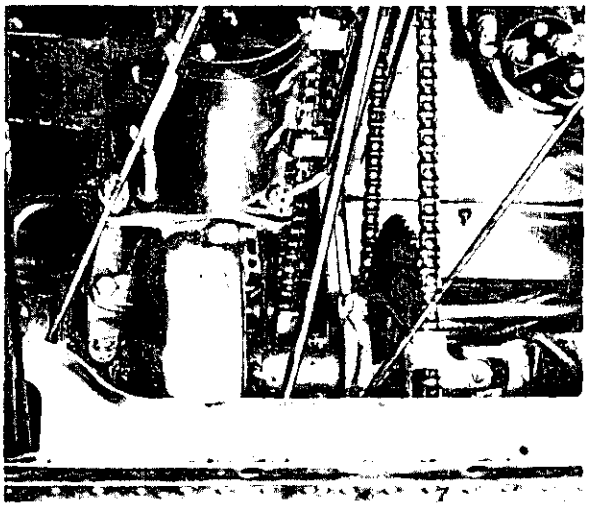
• Any items found not to be within required tolerances should be referred to qualified maintenance personnel for correction and readjustment.



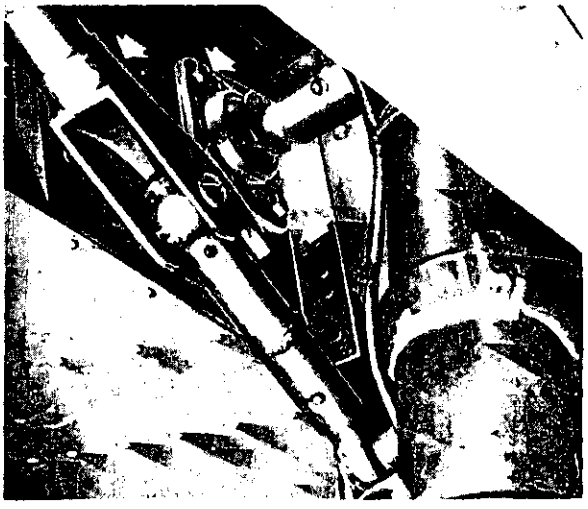
Hydraulic landing gear system.



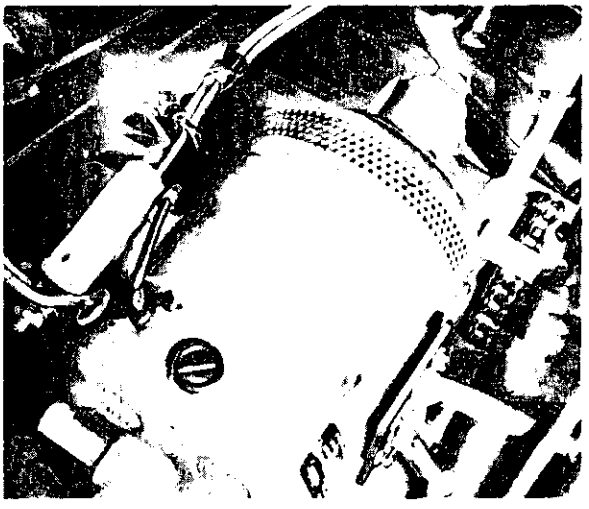
Slide tube.



Sprockets and chains.



Gear attach structure checkpoints.



Electrical retracting motor and wiring.

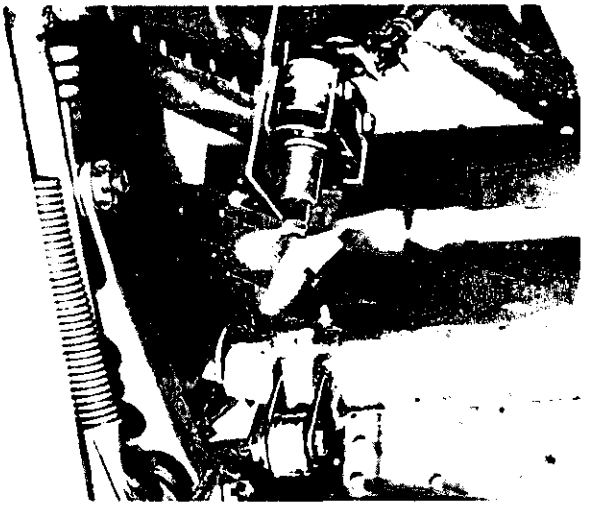
3. Inspect the aircraft structure to which the landing gear is attached for distortion, cracks, and general condition. Be sure that all bolts and rivets are intact and secure.

If the gear is electrically operated, inspect motors for security of attachment and obvious defects. Assure that wiring is in good condition and properly routed and secured to prevent interference with movable members. Determine that protective rubber or plastic caps are properly installed over all wire terminals requiring such protection.

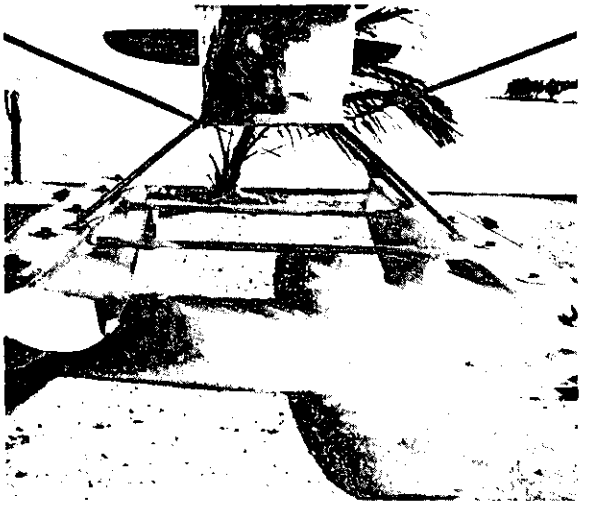
Inspect warning system microswitches for cleanliness, condition, security of attachment and proper operation. With aircraft on jacks, check landing gear warning horn system with electrical power "ON," by retarding throttle with gear retracted. Check wiring for routing, freedom from chafing, and general condition.

• Water accumulation in microswitches may freeze at altitude, making switches inoperative. Only qualified personnel should attempt any adjustments to the microswitches and then only by carefully following the manufacturer's service instructions.

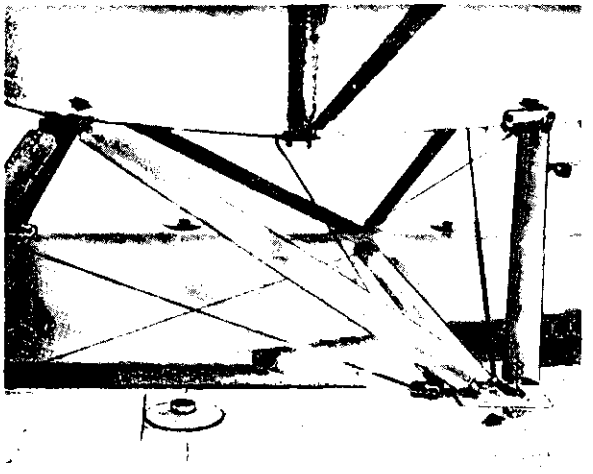
If the landing gear is hydraulically operated, inspect all actuators for general condition, leakage, and operation throughout their full travel. Determine that lines, reservoirs, accumulators, and valves are securely attached



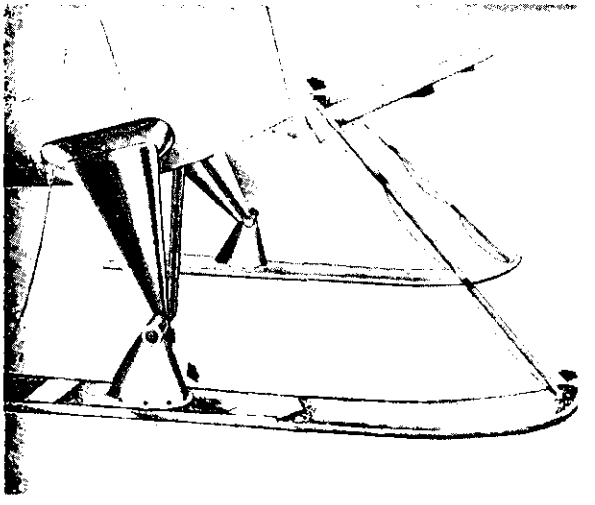
Warning system microswitch installation.



Float installation inspection points.



Float attachment checkpoints.



Ski installation.

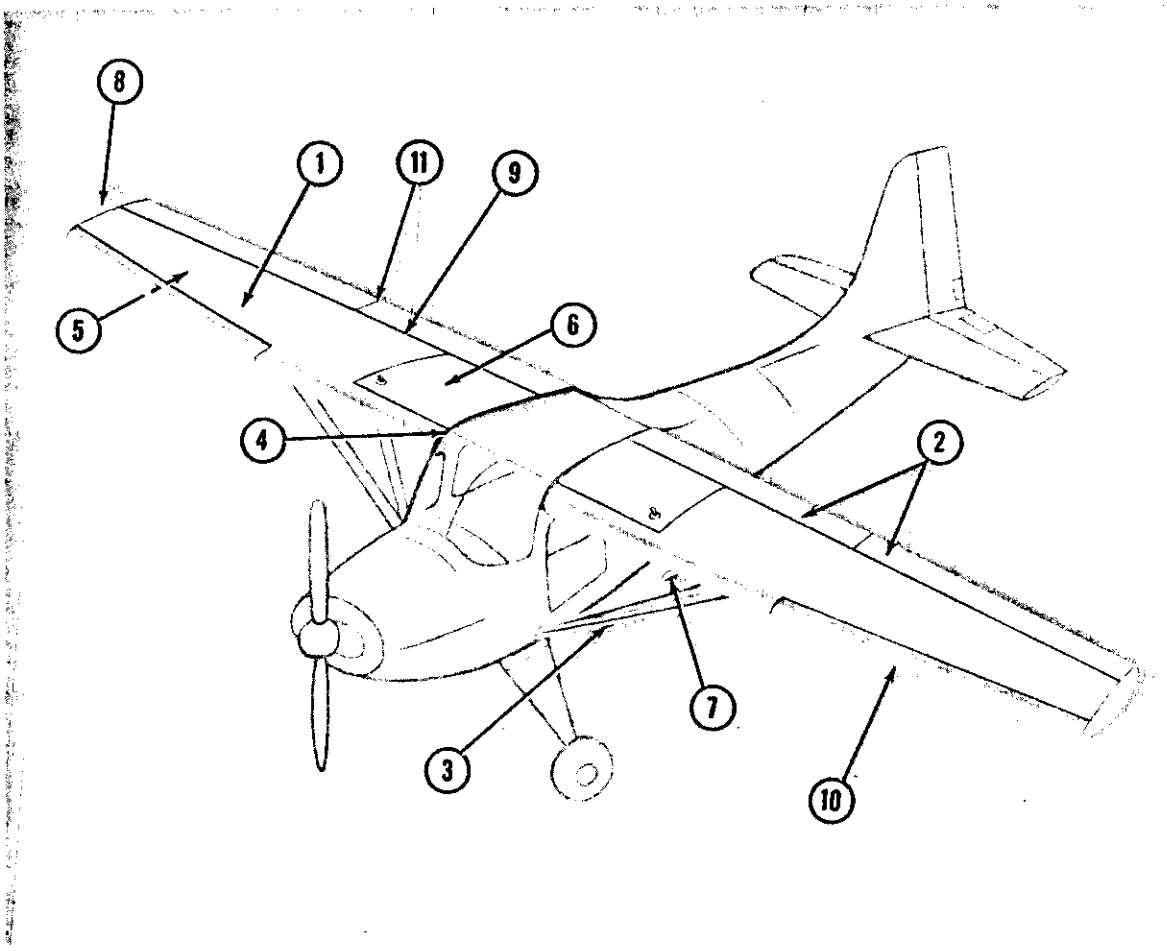
and not leaking. Be certain that the lines are free from chafing and securely attached to the adjacent structure. Check entire gear operation using normal hydraulic pressure.

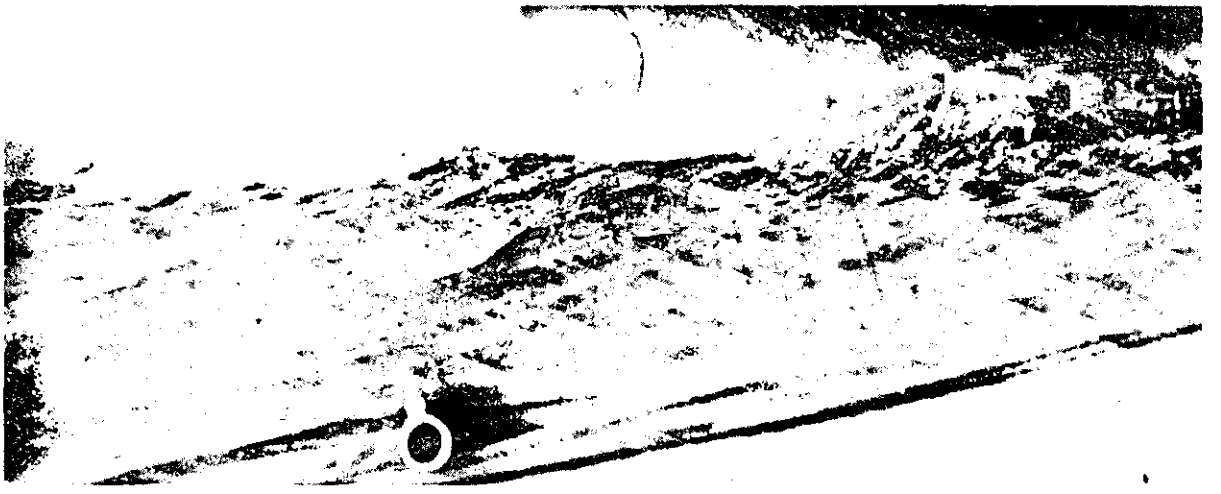
When floats are installed, inspect for obvious or apparent defects and damage. Inspect the general condition of the skin. Check for loose rivets, screws, nails, and condition of glue. Inspect for corrosion and condition of finish. Check the structure for defects or cracks. Drain any accumulation of water from each compartment.

Inspect float attachment fittings for condition, cracks, and defective welds. Examine hinge points for wear. Check struts and bracing for proper attachment, alignment, and safetying. Due to the rigidity of such an installation, a thorough inspection should be made of the fittings and adjacent structure where the struts attach to the aircraft.

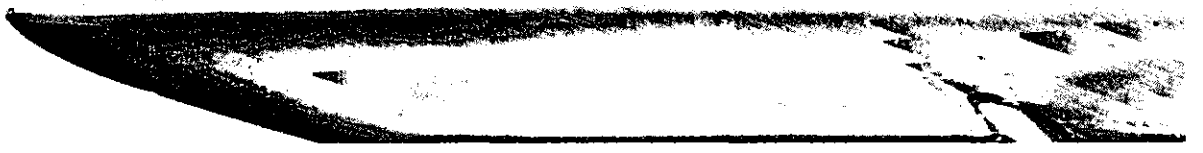
Skis, when installed, should be inspected for apparent or obvious defects, damage, and security of rigging and main axle attachment fittings. Special attention should be given to the ski pedestal. Periodically inspect the ski bottoms for tears or cracks. If installed, check hydraulic system for leaks and proper fluid level. Inspect for condition and proper rigging of all devices restraining the skis from digging into the snow.

INSPECTION CHART — Wing—Center Section





Distorted wing leading edge.



Satisfactory wing leading edge.

Indication of defective fabric.

1. Determine the condition of the wing and center section by carefully inspecting fixed surfaces for signs of deterioration, distortion, and loose or missing rivets and screws, especially in the area of fabric or skin attachment to the structure. Inspect fabric or skin for tears, cuts, or other defects; and examine condition of protective covering. Inspect fabric at windshield for deterioration and security of attachment.

• If the condition of the fabric is doubtful, the advice and assistance of a qualified person should be sought; or samples of the fabric may be taken from portions of the aircraft most affected by the elements and forwarded to an accredited testing laboratory for examination.

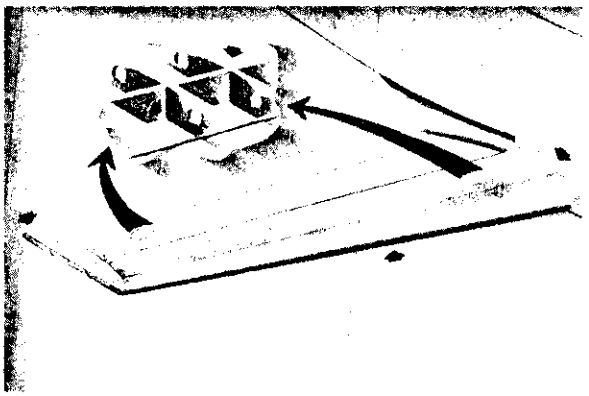
On fabric-covered surfaces, check drainage grommets for security of attachment and for obstructions. Drainage grommets are reinforced openings located usually near the lowest point at the trailing edges of wings and tail

surfaces. These openings provide for drainage of moisture and circulation of air to dry interior surfaces. Seaplane drainage grommets are identified by a hood over the center cutout which minimizes effect of spray during takeoff and landing. This type of grommet should be used on land planes in that part of the structure subject to splash from the landing gear when operating from wet or muddy fields.

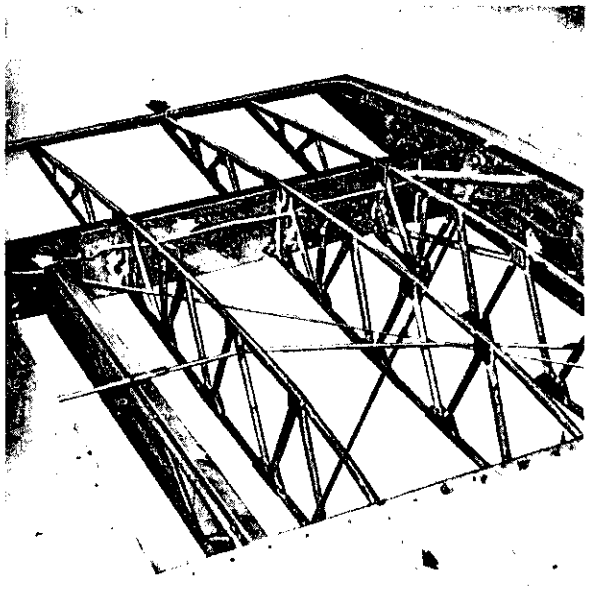
Remove all fairings, fillets and inspection plates and open access doors to inspect for apparent or obvious defects. Examine the internal structure for condition of spars, ribs, compression members, drag wires, rib lacing or other forms of skin attachment. Inspect spars and ribs for cracks, deterioration, or damage. Examine the protective finish and condition of glued joints, when applicable. Check compression members for security, cracks, kinks, or bends. Inspect drag and antidrag wires for proper tension and breakage. Examine skin attachment for security, broken rib lacing, loose rivets, screws, clips, nails, and glue.

The manufacturer's instructions and/or pertinent Federal Aviation Agency publications should be followed if repairs are to be made to the wing structure.

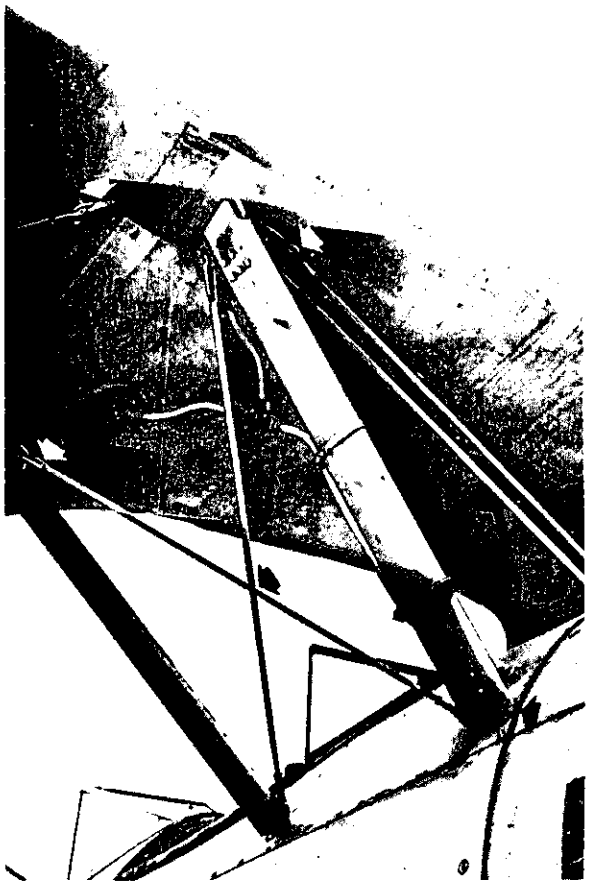
2. Inspect movable surfaces (ailerons, flaps, and trim tabs) for damage or obvious defects. Check for loose or pulled rivets, distortion, unsatisfactory fabric or skin attachment. Examine hinges and horns for security of attachment, breaks, and bends. Inspect hinges for loose or worn pins, proper lubrication, and safetying.



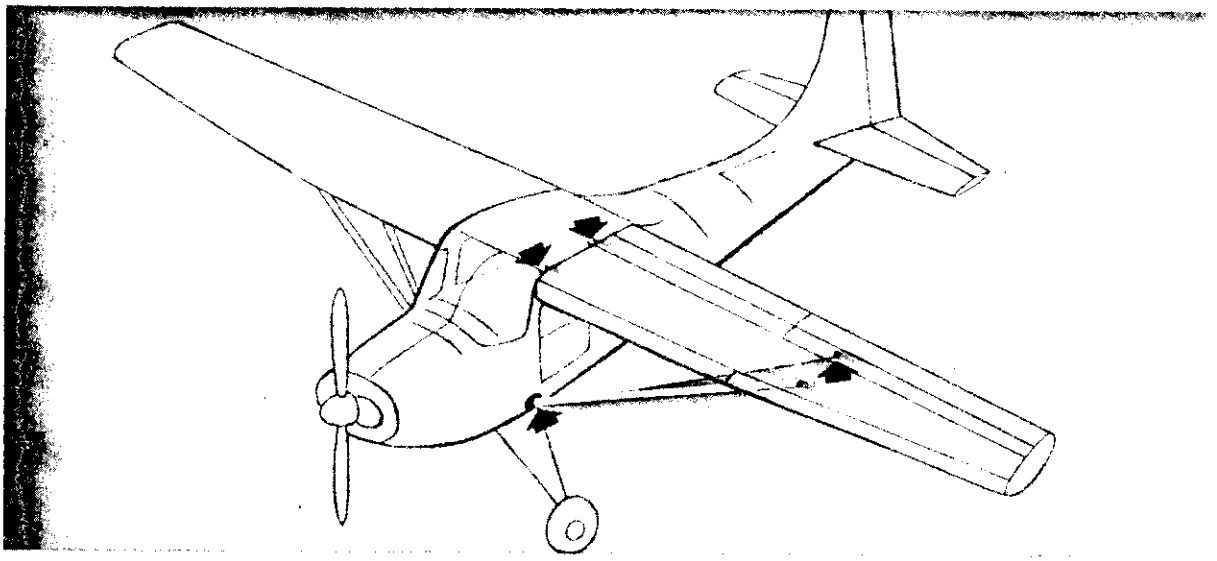
Metal wing inspection points.



Wood structure inspection points.



External brace wire inspection points.



Wing attachment inspection points.

• External distortion may be the result of internal failure. Repairing, refinishing, or repainting of balanced control surfaces (ailerons, elevators, rudders, and trim tabs) of modern high-speed aircraft should not be accomplished unless the surface is rebalanced. Control surface imbalance may cause a dangerous vibration or flutter condition.

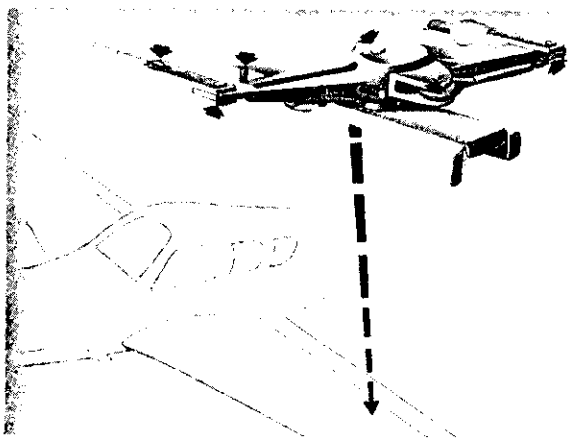
3. Inspect the external brace fittings (struts or brace wires) where they attach to the wing structure for distortion, cracks, or any other defects. Inspect clevises for wear, cracks, worn or damaged threads, and any other apparent or obvious defects.

• If any rigging adjustment of the external bracing has been accomplished, particular care should be taken to assure that there are a sufficient number of threads holding in the adjusting terminals. Most terminals are provided with a test hole in the shank for making this inspection. If safety wire can be inserted through the test hole, the required number of threads are not holding in the terminal. Another method of assuring that sufficient threads have been screwed into the barrel or female fitting is to count the threads on the male fitting. If more than three threads show, the connection is not satisfactory.

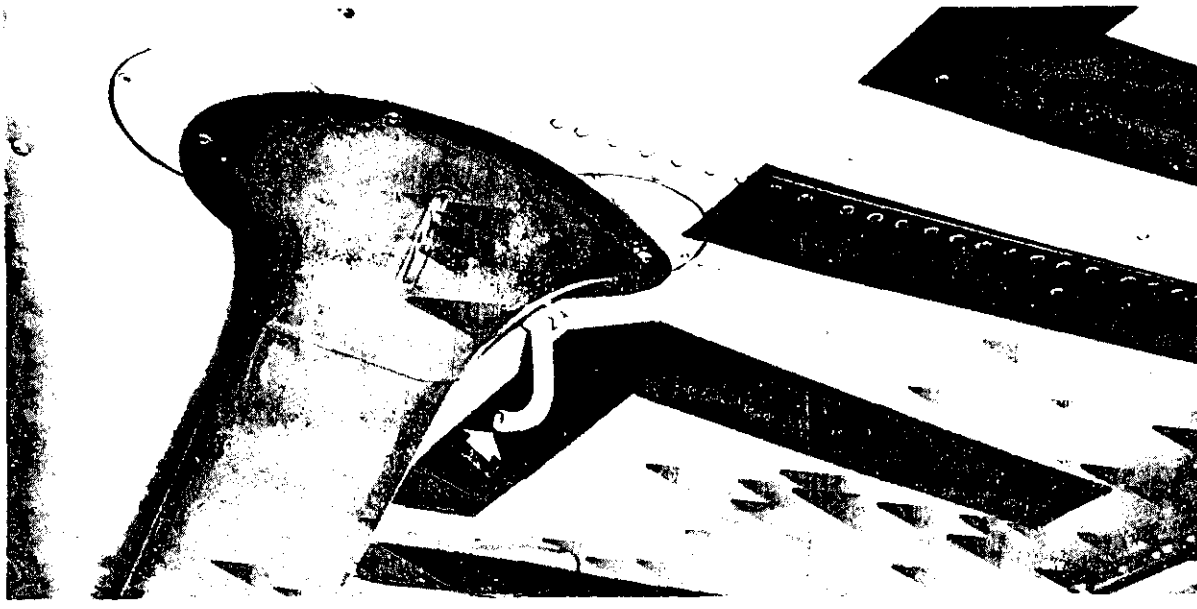
4. Determine that wing attachment fittings are not distorted, cracked, or damaged in any way and that the bolt holes have not become elongated. Check wing attachment bolts for general condition and security of attachment. If wing attachment bolts are loose, tighten to the torque values specified by the manufacturer.

5. Examine the control mechanism for freedom of movement and proper operation. Inspect bellcranks for cracks, alignment, and security. Check cables for proper tension, fraying, wear, and proper routing through fairleads and pulleys. Inspect hinges for breaks, cracks, distortion, and security of attachment.

• Refer to the manufacturer's recommended lubrication procedures.



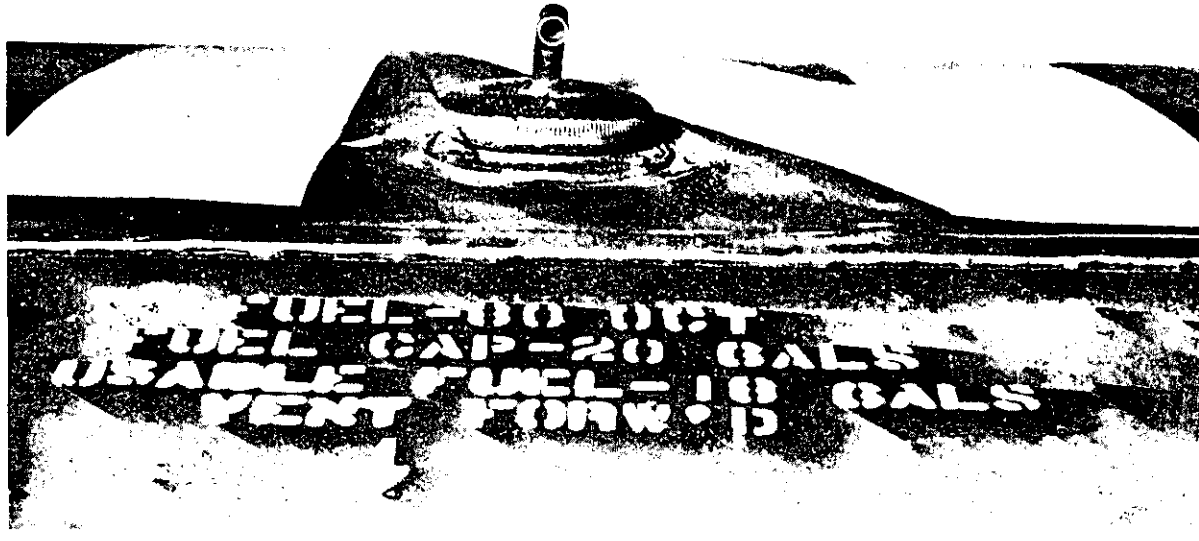
Bellcrank inspection points.



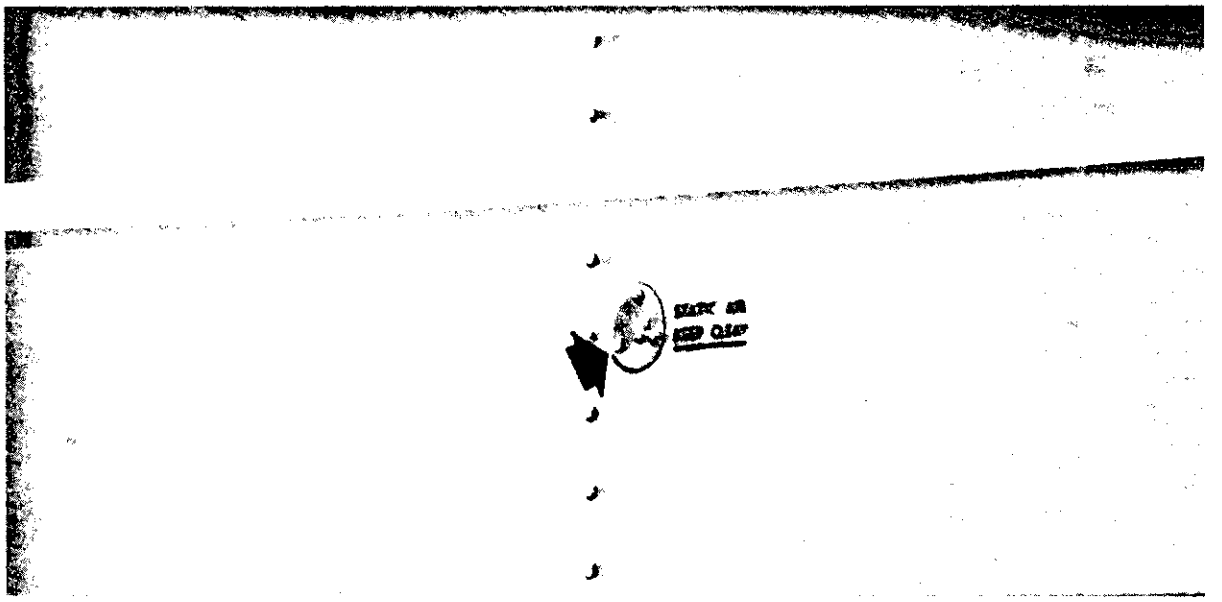
Example of fuel tank vent.

6. Inspect fuel tanks for security of mounting and signs of leakage. Assure that filler caps are secure and the vent is in the proper location and free from obstructions. Check fuel lines and connections for leaks, cracks, security of attachment and chafing. Be sure overflow and drain lines are not kinked or broken and are properly routed to the outside air.

• Improperly placed vents and those that are kinked or otherwise distorted can cause "fuel starvation" and engine failure.



Vent installation and fuel placard.



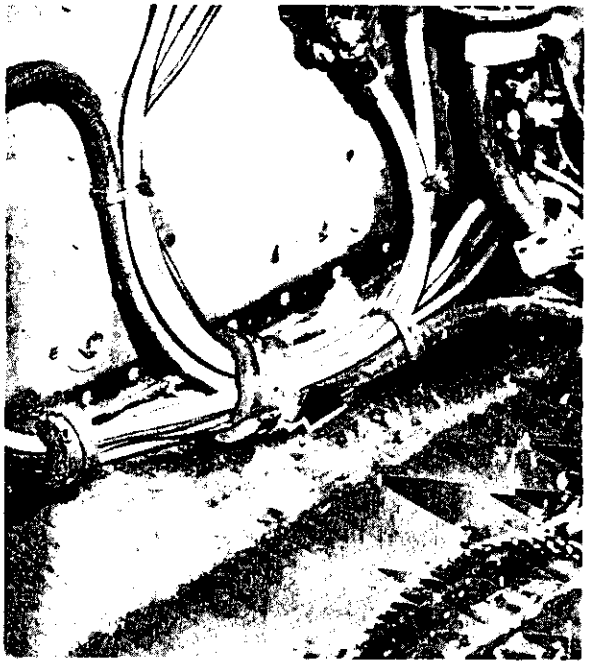
Static ports.

• As a precaution against using the wrong grade of fuel, make sure the placard located at or near the fuel tank filler neck is legible.

7. Inspect pitot tubes or masts for obstructions, distortion, and security. Make sure static vents (ports) are clean and free from obstructions. Periodically, drain and clean out pitot and static lines.

8. Inspect wing tips for obvious damage and for security of attachment. Inspect all wiring for chafing, proper installation, and security. Check installation and condition of grommets, plastic tubing, adapters, and proper taping. Inspect landing lights for extension, retraction, and general condition. Examine navigation lights for condition and operation.

Pitot mast (airspeed).



Proper electrical wire routing.

• Assure that wiring is routed so that it cannot possibly become entangled with movable mechanisms.

9. Be certain that hydraulic lines are free from cracks, kinks, dents, and leaks, and inspect for security of attachment and wear due to chafing. Assure that hydraulic actuators are securely mounted and not leaking.

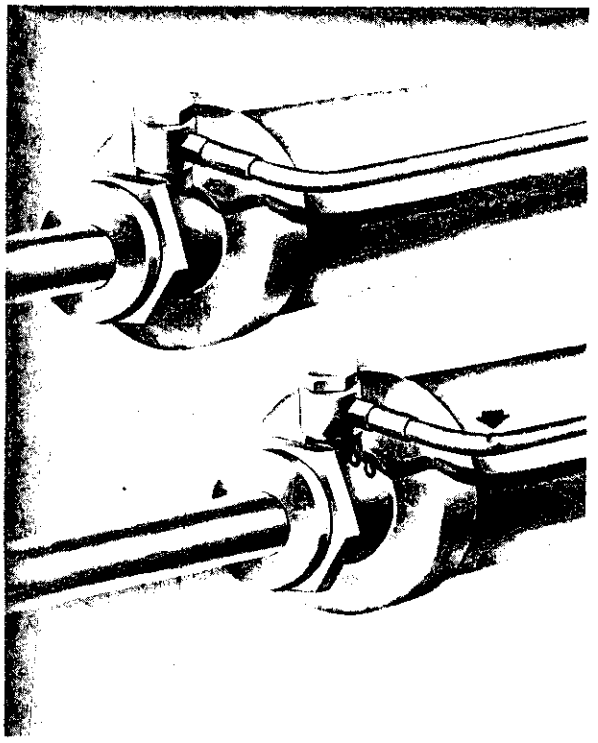
• Any defects noted in the hydraulic system should be corrected by a properly qualified mechanic.

10. Inspect deicing boots, if installed, for proper inflation and deflation. Check for punctures, bruises, loose patches, and security of attachment. Examine deicer pressure lines and fittings for leakage, security, and general condition.

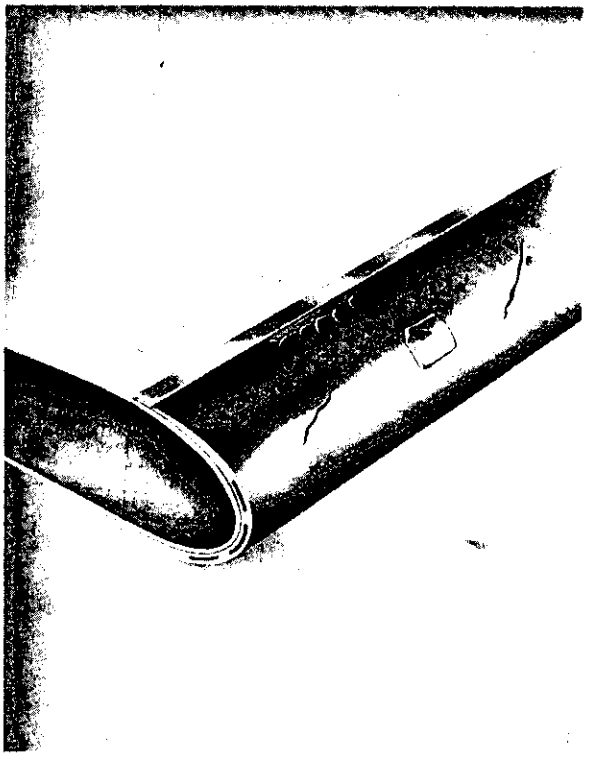
Rubber hose connections from boots to tubing must clear the holes through the structure, and must be secured to prevent distortion of the external surface of the boot.

If thermal anti-icing (hot wings) is utilized, inspect the ducts for leakage, attachment, and satisfactory installation. Examine for corrosion and obvious defects.

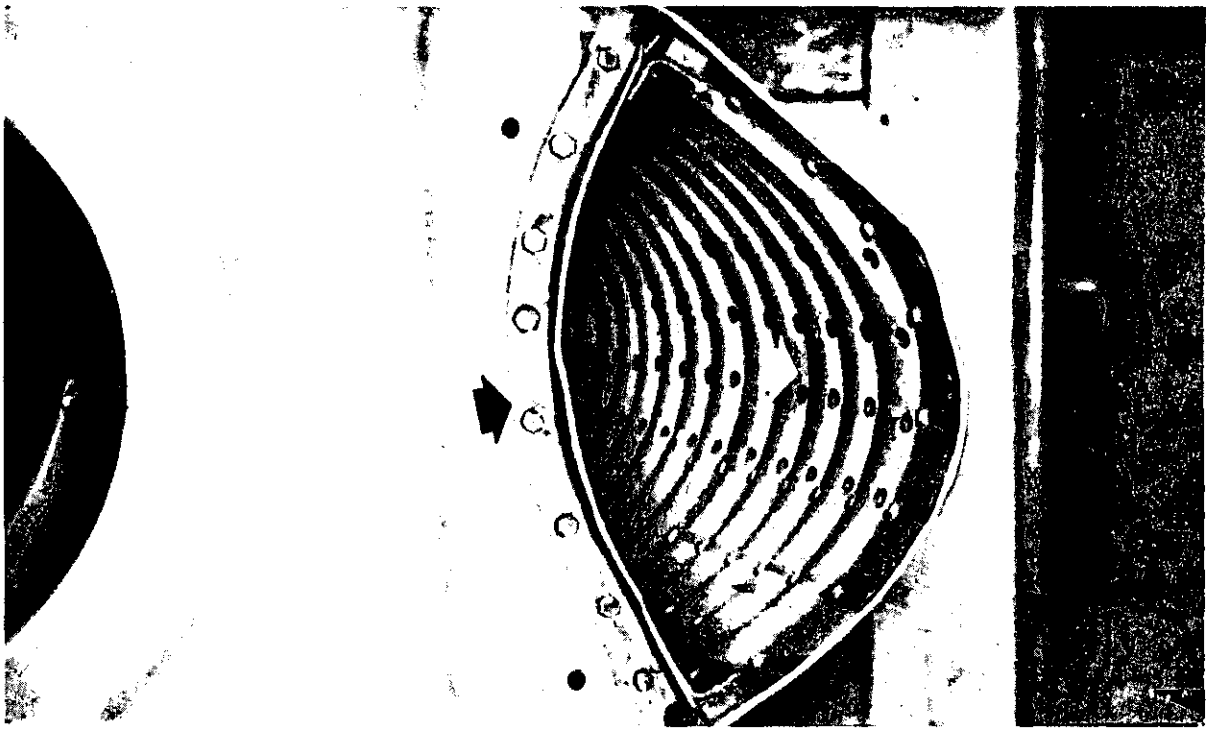
11. Inspect control surface gust locks for condition. Assure that they release completely and cannot possibly engage inadvertently.



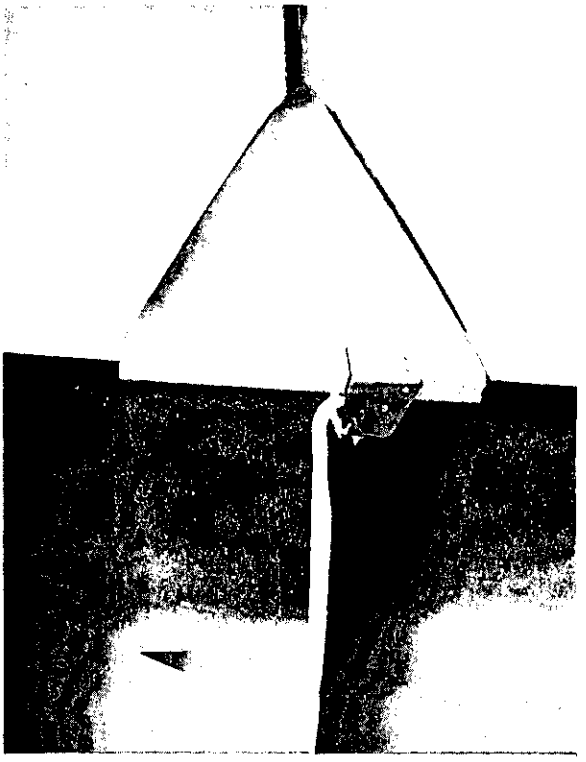
Acceptable and unacceptable hydraulic actuator.



Example of deicer boot damage.

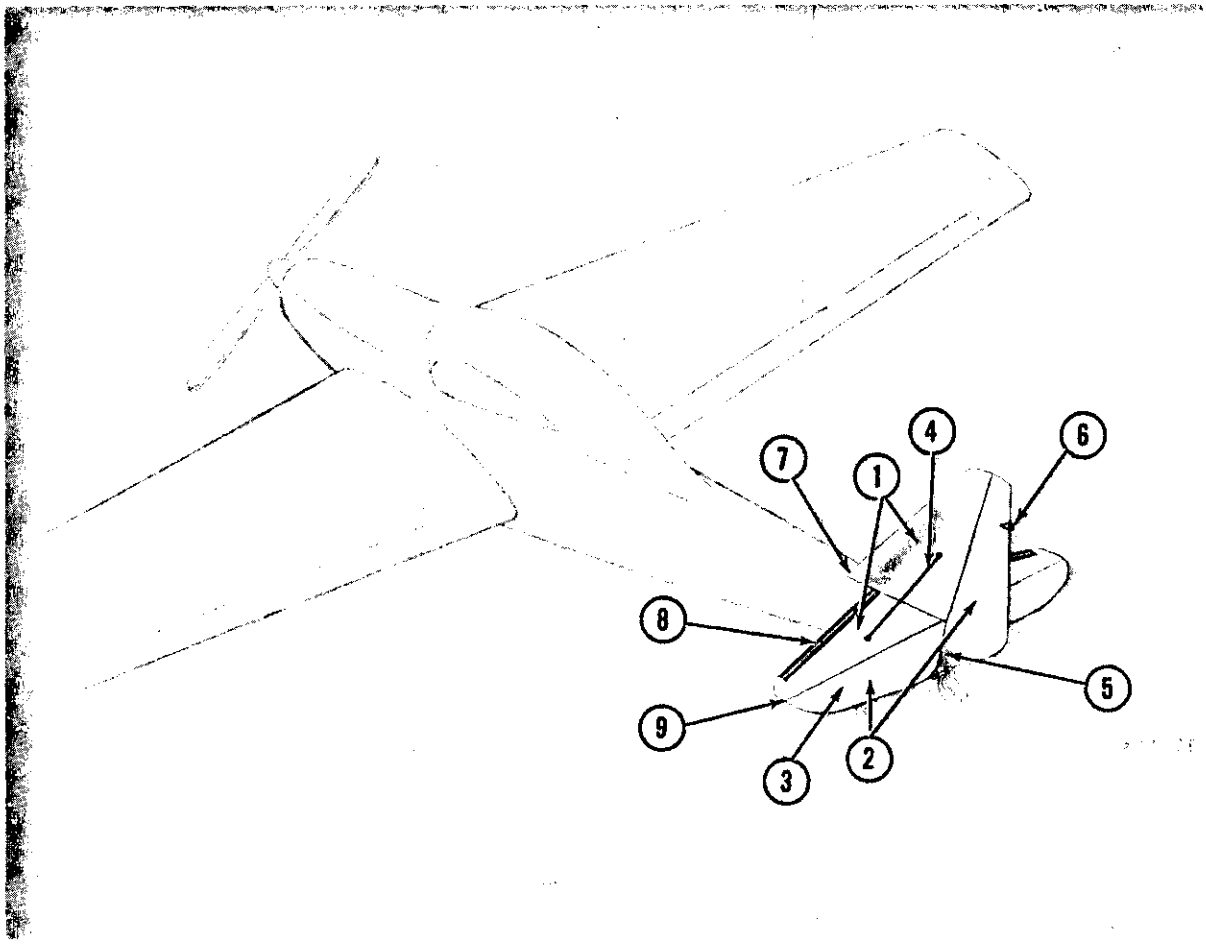


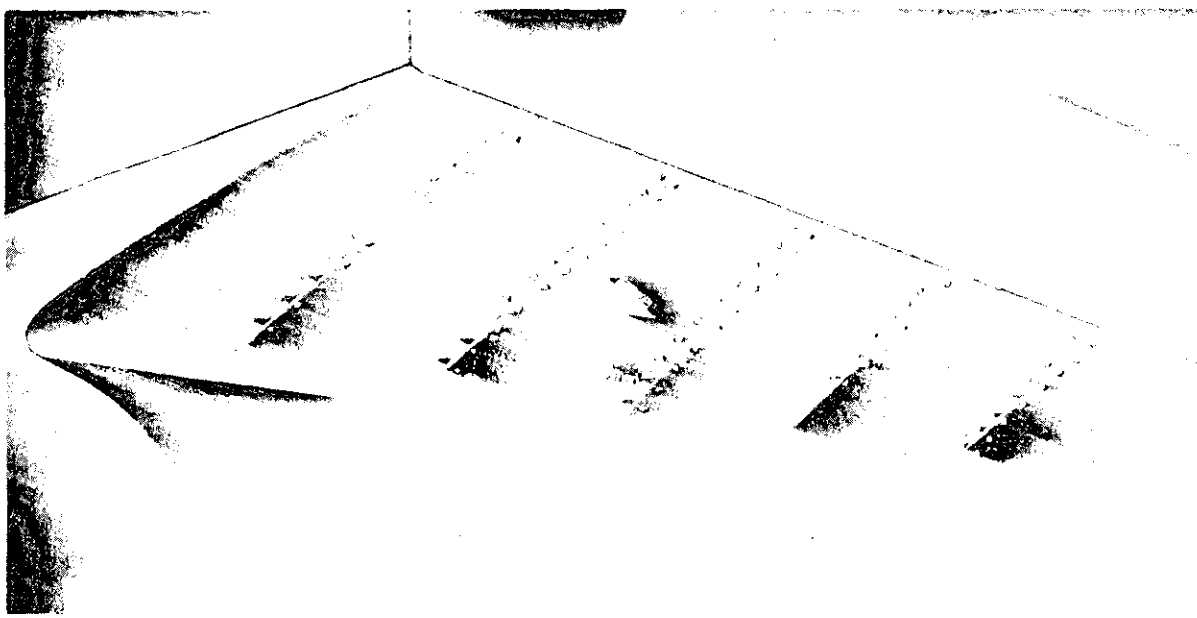
Typical thermal anti-icing duct.



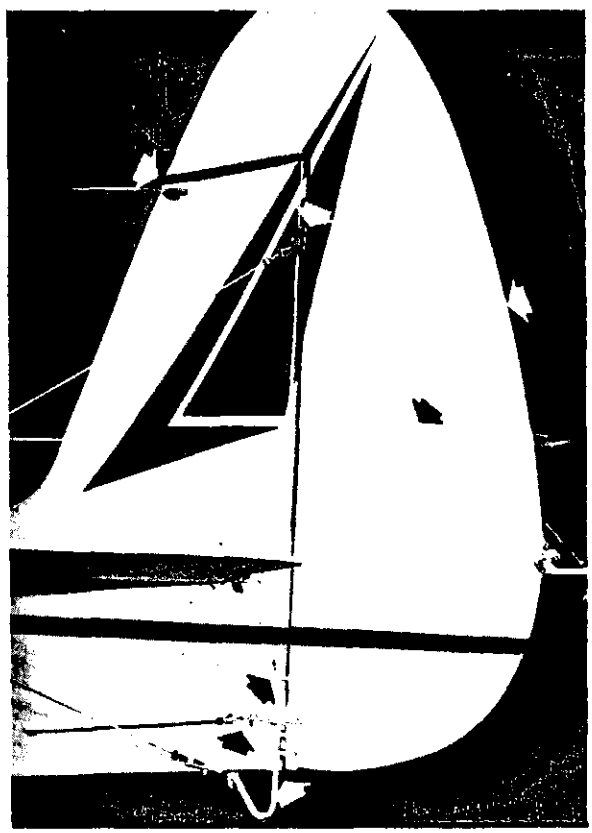
Block-type gust lock.

INSPECTION CHART — Empennage





Oil canning of metal skin.



Rudder checkpoints.

1. Inspect fixed surfaces for damage or obvious defects, loose rivets, screws or bolts, condition of covering, cracked fittings, failure of glued joints and condition of drainage grommets or holes. Examine condition of ribs and stabilizer spars at points of attachment for cracks and elongated bolt holes. Inspect protective coating for deterioration.

• Distortion of fabric or skin may indicate internal structural damage in the general area where the distortion is evident.

2. Movable control surfaces, such as elevators, rudders, and trim tabs, should be examined for damage or obvious defects, loose rivets, loose fabric or skin distortion, and unsatisfactory glue joints. Inspect hinges and horns for security of attachment, breaks, or bends. Examine hinges for loose or worn pins, proper lubrication, and safetying.

• If excessive clearance is detected in the hinges, a qualified mechanic should determine corrective action needed.

3. Examine fabric or skin for abrasion, tears, cuts or other defects, distortion and deterioration. Check condition of protective finish and drainage grommets. Assure that the fabric or skin attachment to the structure is satisfactory.

Example of damaged covering.

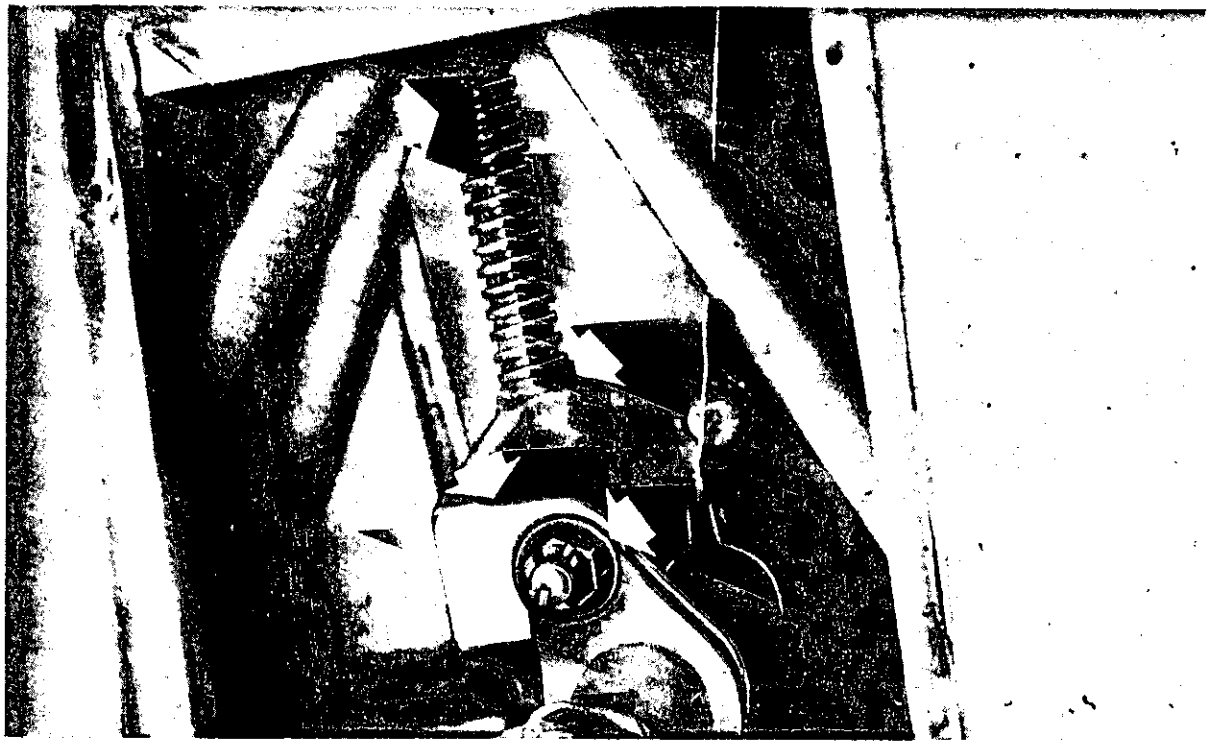
4. Inspect external bracing attachment fittings for distortion, cracks, and security of attachment. Check struts or brace wires for condition and security of attachment. Examine clevises for cracks, worn or damaged threads, and any other apparent or obvious defects.

• Bracing must not be slack, which could cause flutter, nor must there be excessive tension, which might distort or damage fittings or attachments. If there is any question concerning condition of the external bracing, consult a qualified mechanic.

5. Inspect control cables and bolts for wear at horns or bellcranks; look for such things as frayed or chafed cables, pulleys not turning, misplaced cable guides, rusty or corroded tubing, and broken welds. Inspect trim adjustment mechanism for excessive looseness, security of attachment and proper operation of the trim adjustment position indicator.

• If the aircraft is trimmed by either an adjustable stabilizer or trim tab, they must operate freely throughout their designed range of travel. Lubricate as required, following the manufacturer's recommendations.

External bracing inspection points.



Adjustable stabilizer checkpoints.

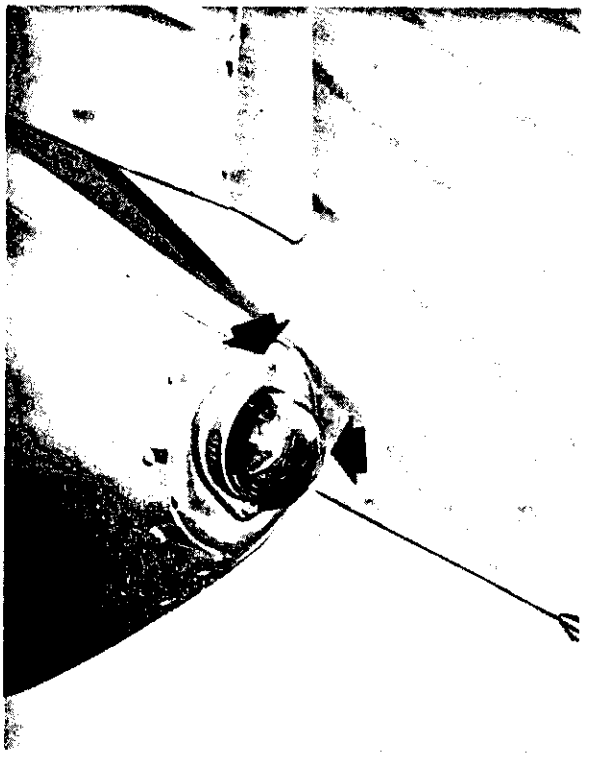
6. Inspect navigation lights for condition and operation. Check wiring for chafing, proper installation, and security of attachment. Check installation of grommets, plastic tubing, adapters, and proper taping.

7. Examine hydraulic lines for cracks, kinks, dents, or leaks and inspect for security of attachment and wear due to chafing. Assure that hydraulic actuators are securely mounted and free of leaks.

8. Inspect deicer boots, if installed, for proper inflation and deflation, punctures, bruises, loose patches, and security of attachment. Check feed lines and fittings for leakage, security, and general condition. If thermal anti-icing is used, inspect the ducts for corrosion, leakage, attachment, satisfactory installation, and for obvious defects.

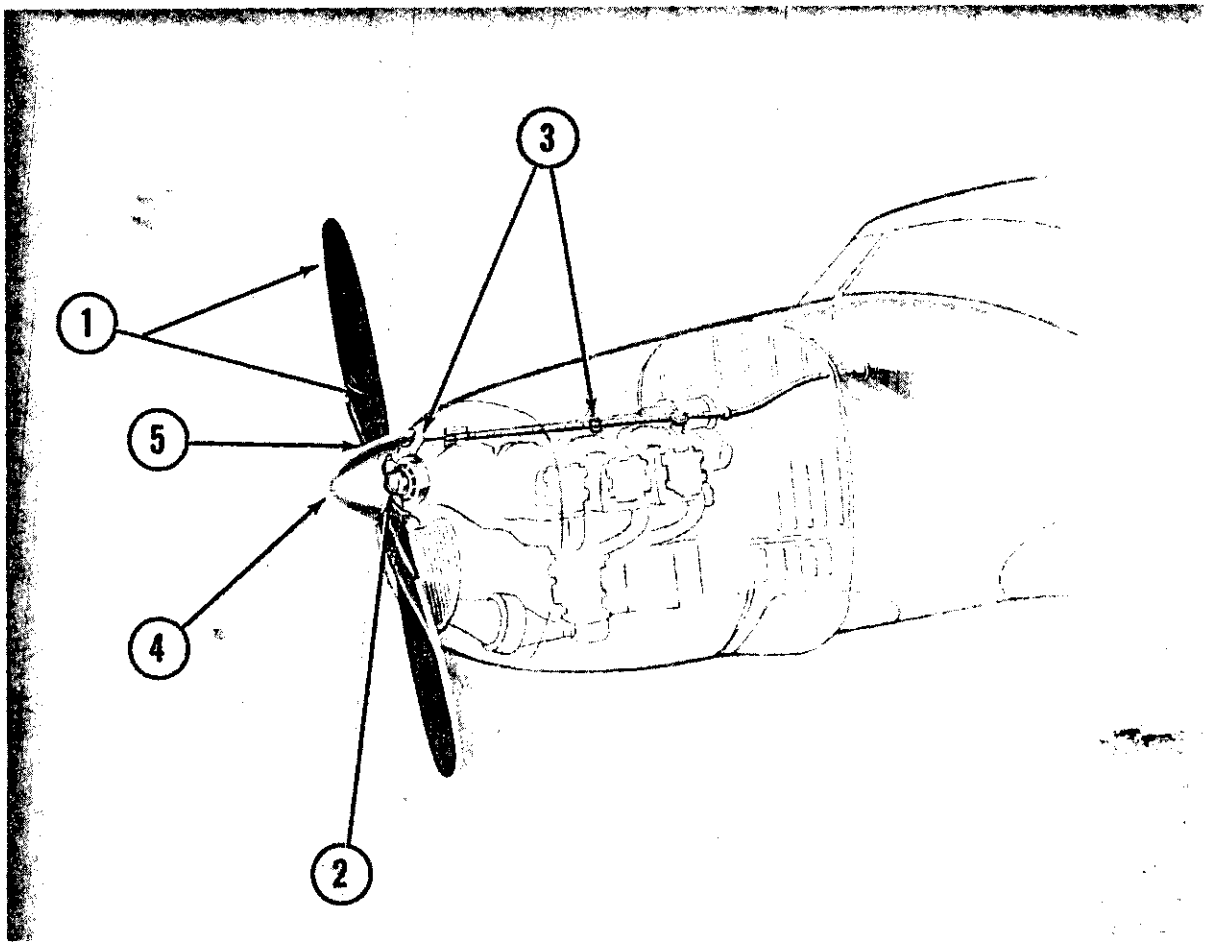
- Follow procedures specified by the manufacturer in regard to specific repairs found to be necessary as a result of this inspection.

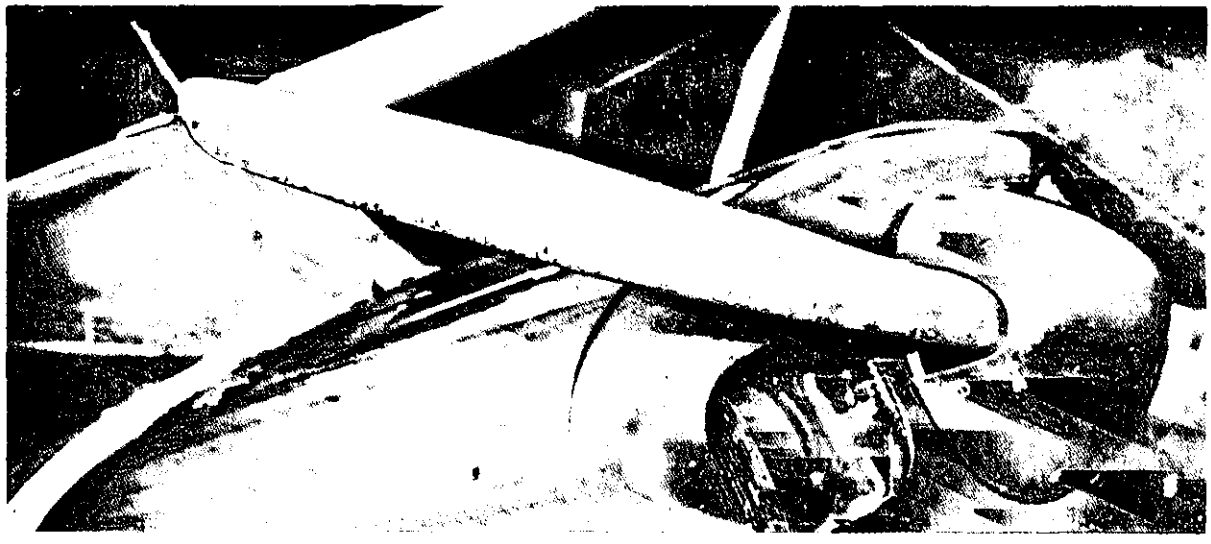
9. Inspect gust locks for condition. Assure that they release completely and cannot possibly engage inadvertently.



Position light checkpoints.

INSPECTION CHART — Propeller



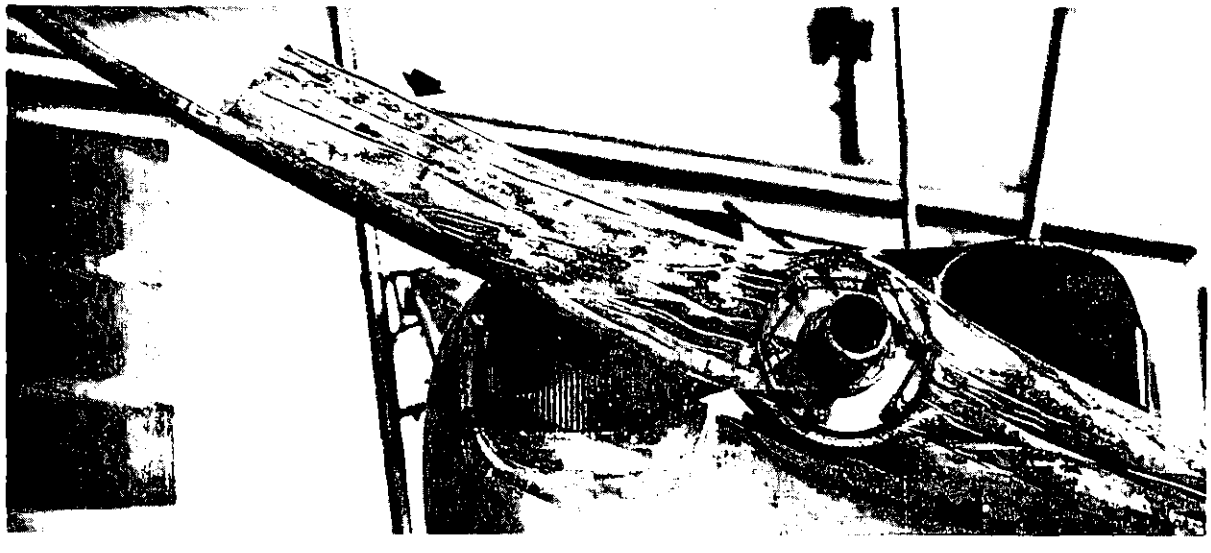


Nicked and scratched metal blade.

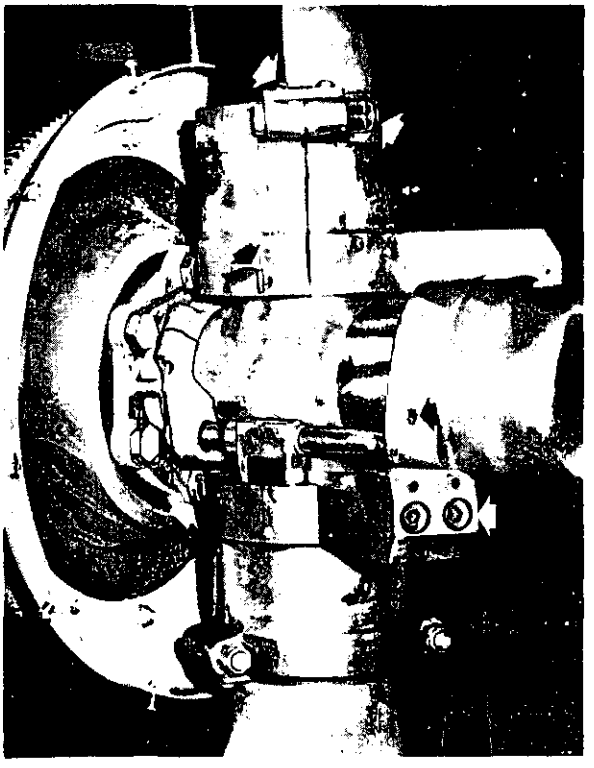
If any unsatisfactory conditions are found while inspecting the propeller, a qualified mechanic should be consulted for a determination whether repairs or replacements are necessary. All propeller repairs, other than a few minor ones, must be accomplished by either the manufacturer or a propeller repair station. Hubs should be lubricated as recommended by the manufacturer, using lubricants listed in pertinent instructions.

• A propeller blade should never be used as a handhold for moving an aircraft. It is extremely easy to impose forces on a blade in excess of those for which the blade was designed.

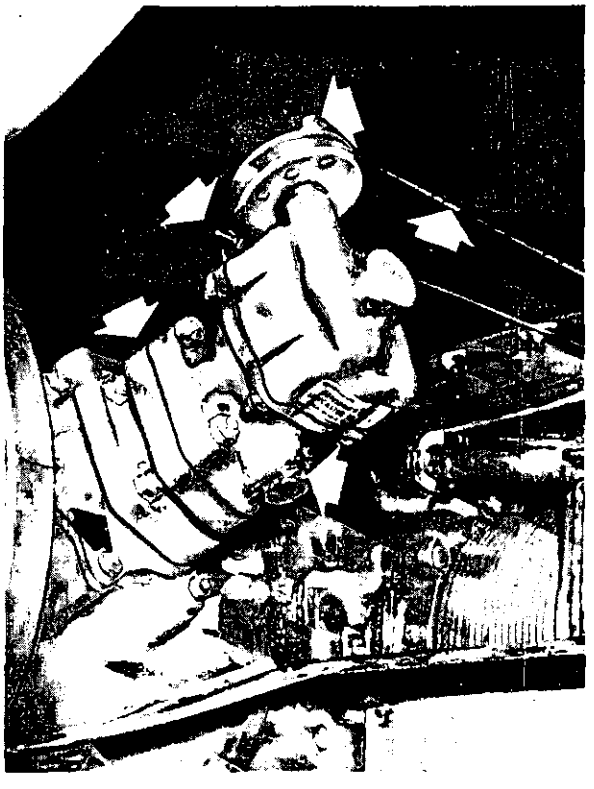
1. Inspect metal blades completely for corrosion, cracks, nicks, and scratches, particularly on the leading edge of each blade from the tip inboard for approximately 8 inches. Nicks and scratches set up concentrations of stress which can exceed the strength of the blade material; the result will be a crack and premature failure of the blade.



Cracked wooden blade and separated laminations.



Propeller hub checkpoints.



Propeller governor inspection points.

Wood or composition blades should be inspected for condition of metal tipping and leading-edge strips. Check for loose rivets or screws, separation of soldered joints, and other signs of creeping and looseness of the metal tipping. Check for lamination separation, especially between the metal leading edge and cap, and condition of fabric sheathing. Inspect tip for cracks by grasping with the hand and slightly twisting and bending tip backward and forward. A fine line appearing in the fabric or plastic will indicate a crack in the wood. Assure that tip drain holes are open. Tip drain holes must be open so that the centrifugal force of the revolving propeller will dissipate excess moisture. If other than a fixed-pitch propeller, make certain that the blades are installed in the hub satisfactorily and properly safetied. The wood close to the metal sleeve of wood blades should be examined frequently for cracks extending outward on the blade.

2. Inspect the hub for corrosion, cracks, oil leaks, security of attachment, and safety. Assure that propeller retainer bolts are tight and properly safetied.

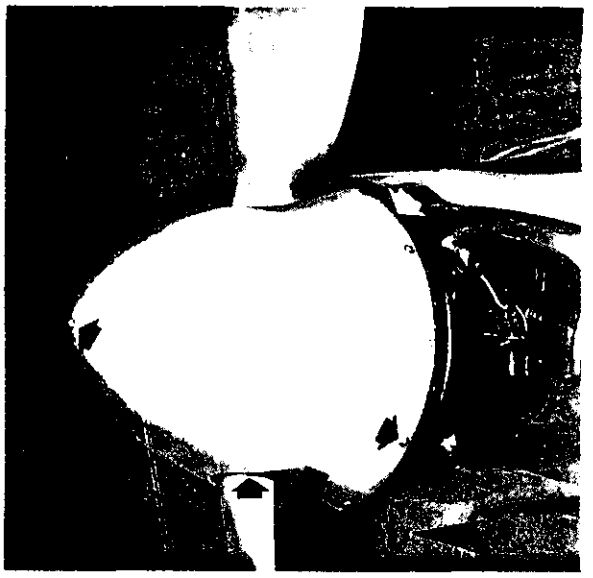
3. Inspect the propeller control system for security of attachment, oil leaks, and freedom of movement. Inspect wiring for condition, routing, damage, and chafing. Inspect tubing for security, kinks, scratches, oil leaks, and chafing. Assure that all exposed nuts are tight and properly safetied.

The control system may incorporate a full feathering system including relays, solenoids, governors or control valves, and distributors. Inspect the various external components of the system for security of attachment, oil leaks, chafing, or obvious damage to the electrical wiring. Check for loose connections and proper safetying.

Certain engine–propeller combinations require that a spinner be installed to facilitate proper engine cooling. In this case, the engine should not be operated unless the spinner is properly installed.

4. If installed, inspect the propeller spinner and spinner mounting plate for security of attachment, cracks, chafing of the blades, apparent or obvious defects and proper safetying.

• Cracked spinner assemblies must be removed and repaired immediately by a qualified person



Propeller spinner inspection points.

to prevent the possibility of parts breaking away from the spinner in flight and seriously damaging portions of the aircraft structure, or injury to personnel while operating on the ground.

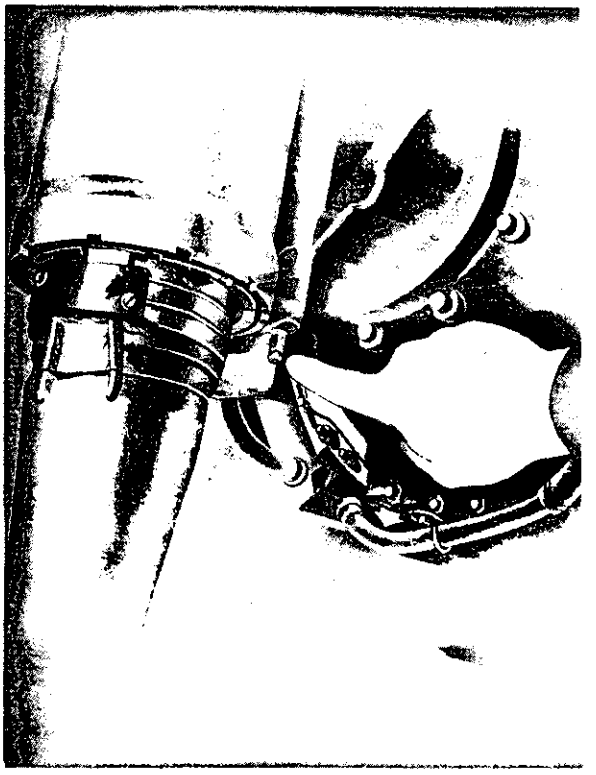
5. Inspect the fluid anti-icer assembly for general condition and security. Assure that the slinger ring, nuts, and delivery tubes are properly installed and that the nuts holding the delivery tubes to the slinger ring sockets are securely fastened. Inspect fluid level, and reservoir and lines for proper installation, chafing, and leakage. Check connections for condition and security of clamps.

• Follow manufacturer's instructions when filling reservoir with anti-icing fluid.

If the system depends on electrical heat for the removal of ice, inspect the deicing shoe for damage and condition of the electrical connection to the blade. Examine blade slip rings and brush holders for condition and attachment. Check cockpit controls for condition and satisfactory operation. Inspect wiring for chafing, routing, deterioration, and security.

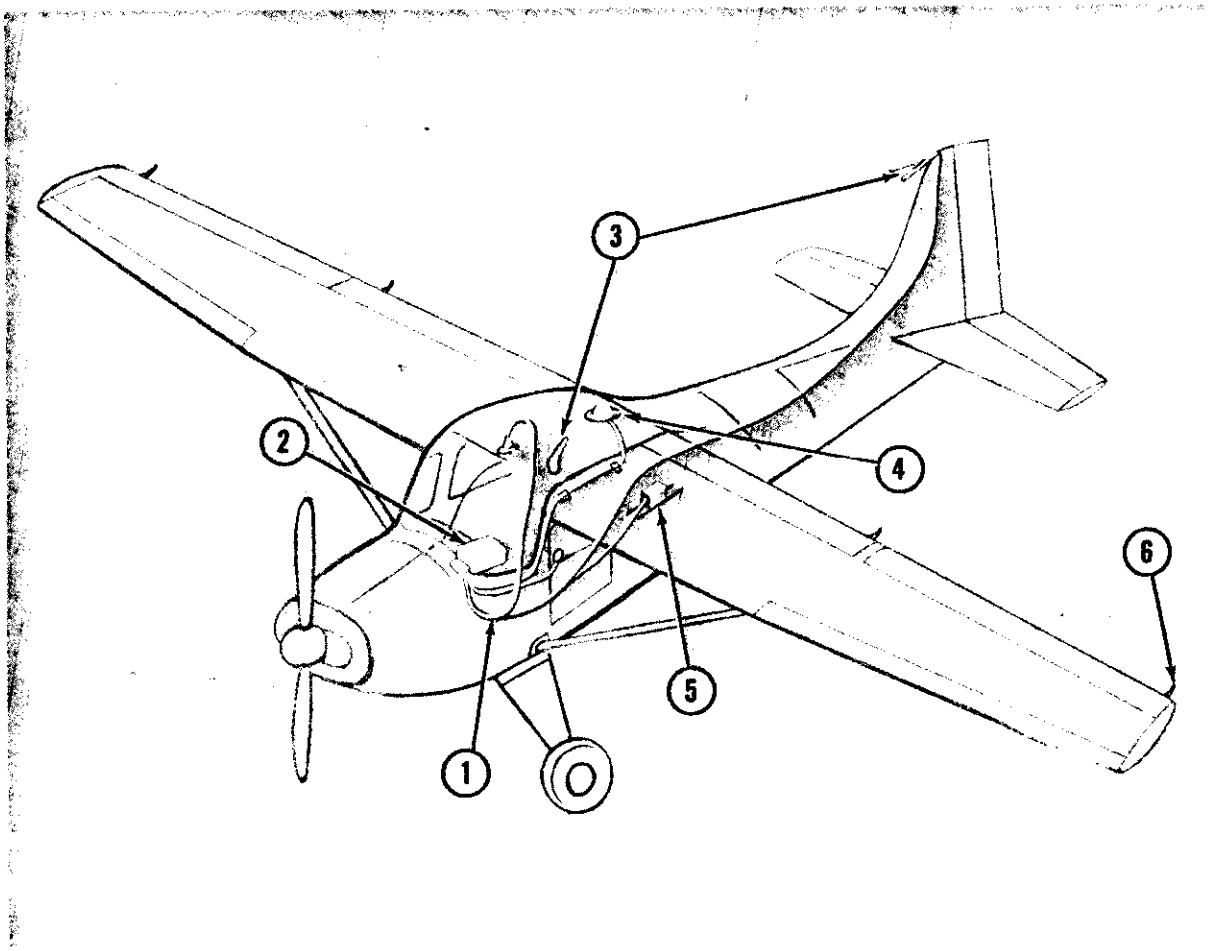
• Defects noted in the deicing system should be referred to a qualified mechanic for adjustments and repairs. Severe damage to the shoe will require replacement. Normally, small cuts may be repaired with a sealer specified by the shoe manufacturer.

Fluid-type anti-icer inspection points.



Electrical deicing system checkpoints.

INSPECTION CHART — Radio

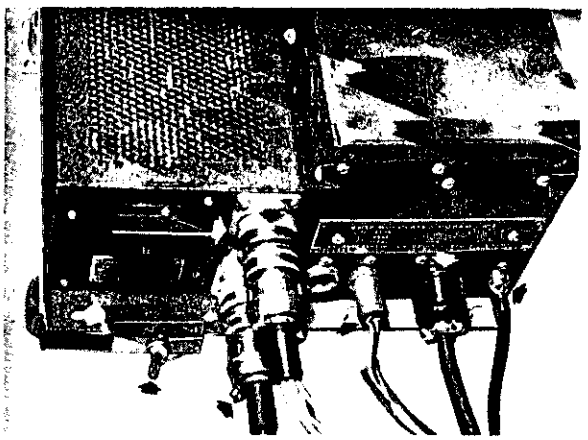


1. Inspect electrical wiring and shielding for defects, chafing, and security; assure that connections, terminals, and clips are tight. Look for evidence of shock mounted equipment contacting adjacent components or structure. Check fuses for corrosion, condition and security.

Periodically, radio equipment should be removed to inspect shock mounts and bonding and to clean and inspect racks and adjacent structure. Plugs and connectors should be opened and inspected for corrosion, dirt, and moisture. Assure that all plugs and connectors are properly mated and secured.

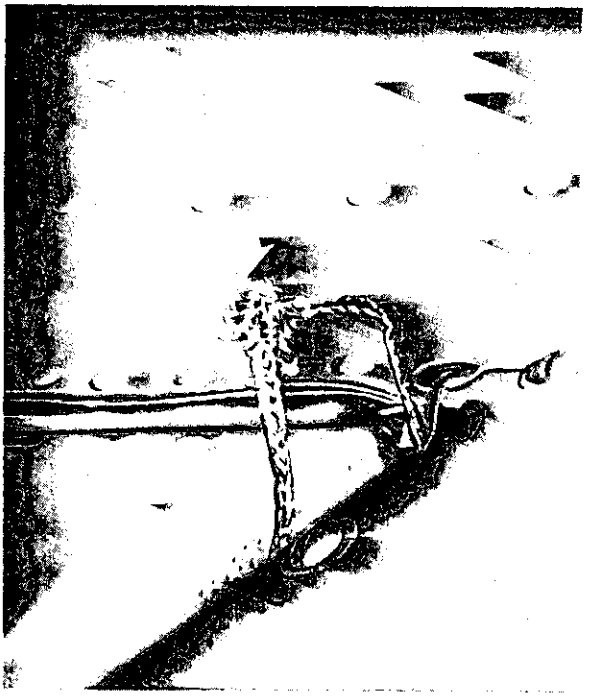
• Disconnect battery ground cable BEFORE removing radio equipment.

Generally, no serious consequences other than poor reception will result from broken bonding strips. To be sure the radio will be available and operating satisfactorily when needed, action should be taken to replace or repair damaged bonding.

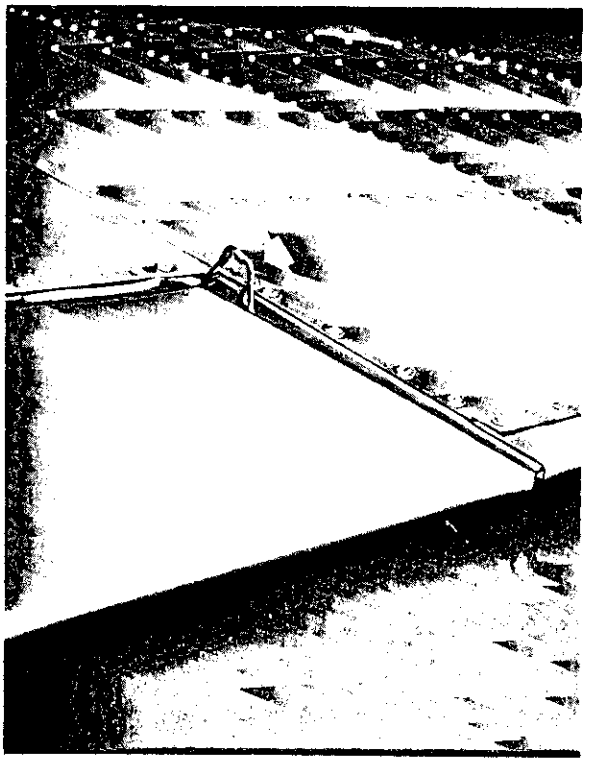


Communication/navigation equipment installation checkpoints.

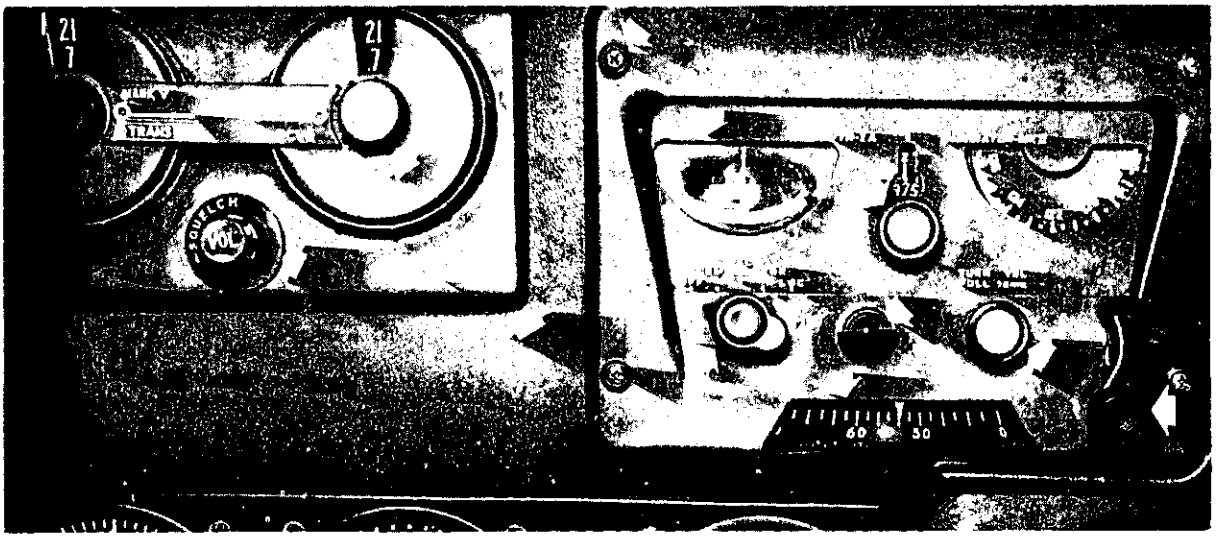
2. Examine installation of communication and navigation equipment (radio, ADF, OMNI, DME, etc.) for security of attachment. Check all jacks, knobs, and switches for security. Volume controls should work smoothly. Switches should have positive action. Indicator dials should be clean and have proper motion. Check for defective light bulbs. Spare light bulbs and fuses should be readily available in the cockpit or cabin.



Broken bonding on control hinge.



Satisfactory bonding on control hinge.



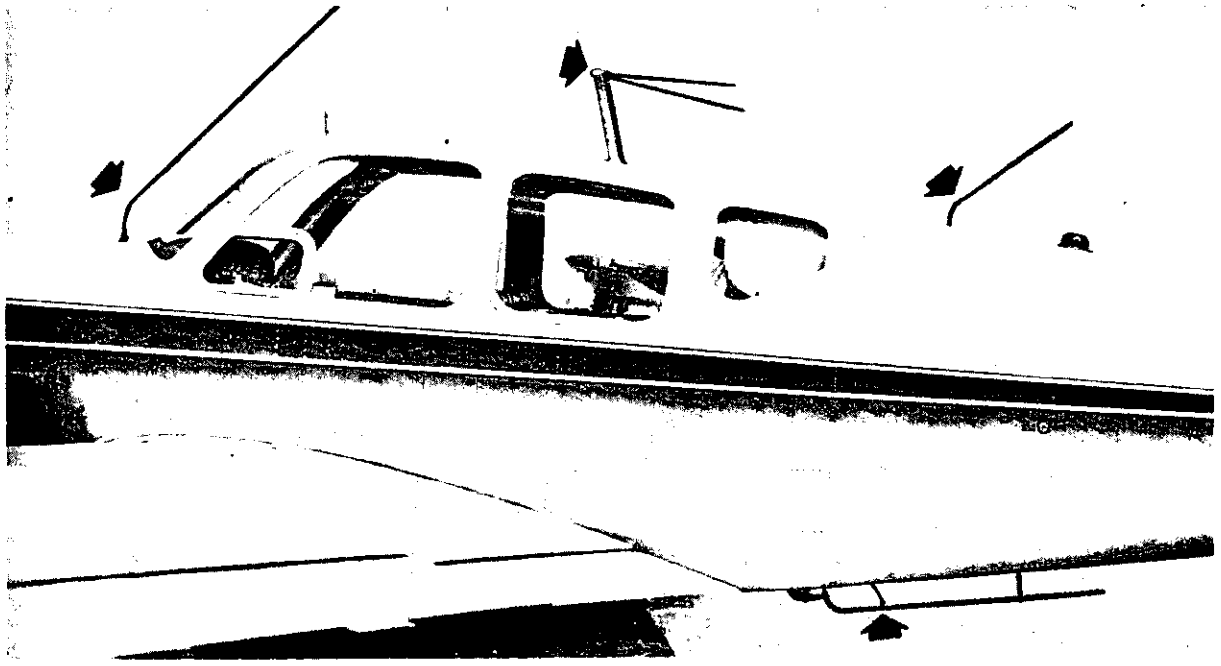
Communication/navigation panel checkpoints.

Headsets and microphones should be inspected for broken or sticking switches, dirty, worn, or damaged plugs. Inspect cord for wear or damage.

If a portable radio is used, some means of securing the unit should be provided in the aircraft to keep it in place during turbulence in flight.

• Unsatisfactory operation of communication or navigation equipment should be referred to authorized personnel for repair or adjustment.

Open junction boxes and inspect for extraneous material, security of connections, and condition of wiring and cables. Inspect remote control shafts for condition, security, and ease of operation.



Antenna installation.

3. Check antennas for condition and security of attachment. Inspect wire antennas for proper tension. Inspect insulators, fittings, terminals, and supporting masts for condition and security. Clean all insulators.

• A broken antenna may foul the controls or cause other serious damage. Inspect rigid antennas and masts for evidence of lightning strikes. Check rubber seals for evidence of cracks or leakage.

4. Check manual and automatic rotation of loop.

• Refinishing of the loop housing requires a special kind of paint.

5. Inspect power supply installation for security of attachment. Check wiring and connections for proper grounding, condition, insulation, and security. Check switches for operation and condition.

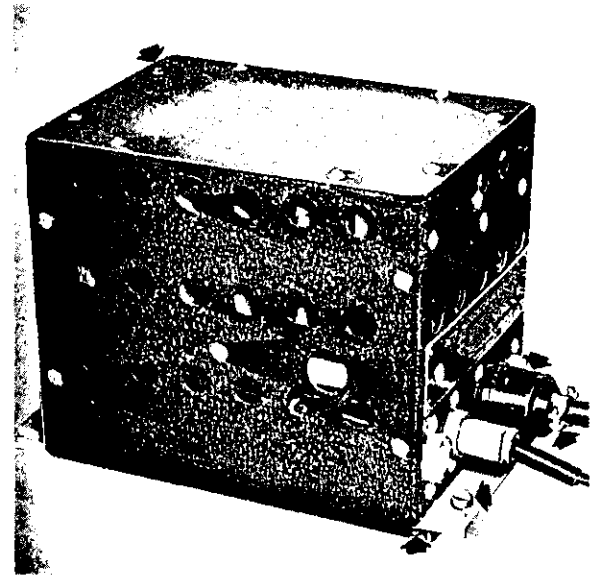
• Periodically check dynamotors for security of attachment and cleanliness.

6. Inspect static trailing wicks for proper length, condition, and security.

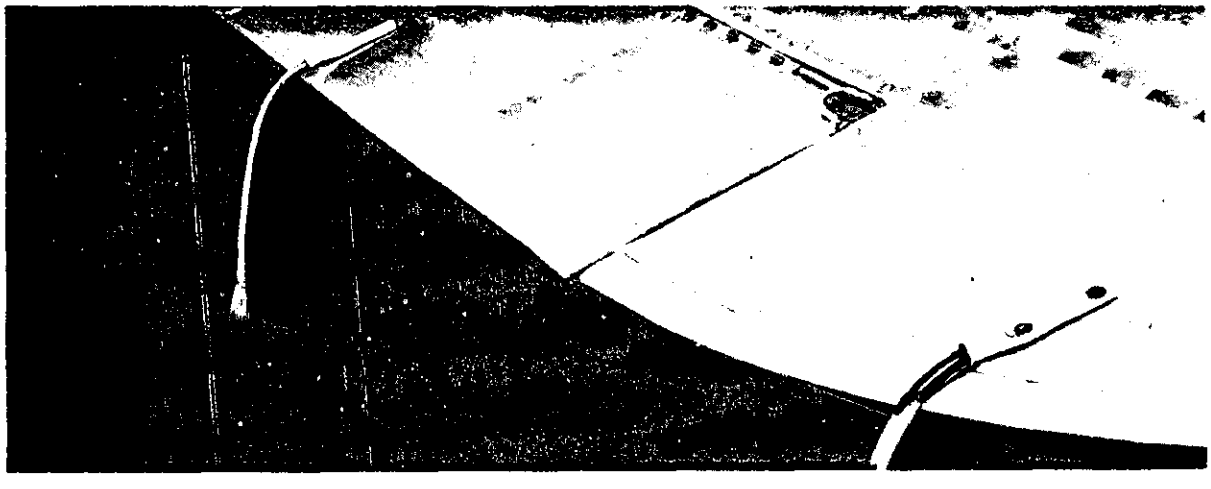
• An operational check should be performed on all equipment during engine warmup. Reception should be free of interference caused by ignition, generators, navigation lights, or any other electrical or mechanical unit.

Periodically check the voltage regulator system. Low voltage setting will result in improper radio operation. High voltage setting (over 10 percent) may result in damage to radios, particularly those incorporating transistors.

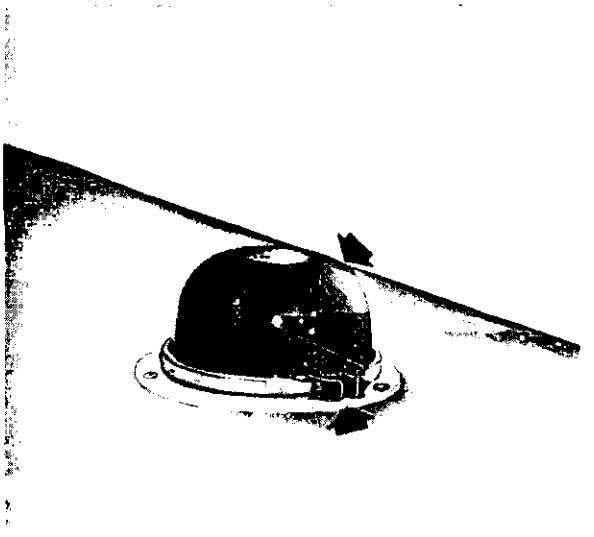
Loop housing.



Nonshock mounted modulator power supply.



Static trailing wicks.



Rotating beacon installation.

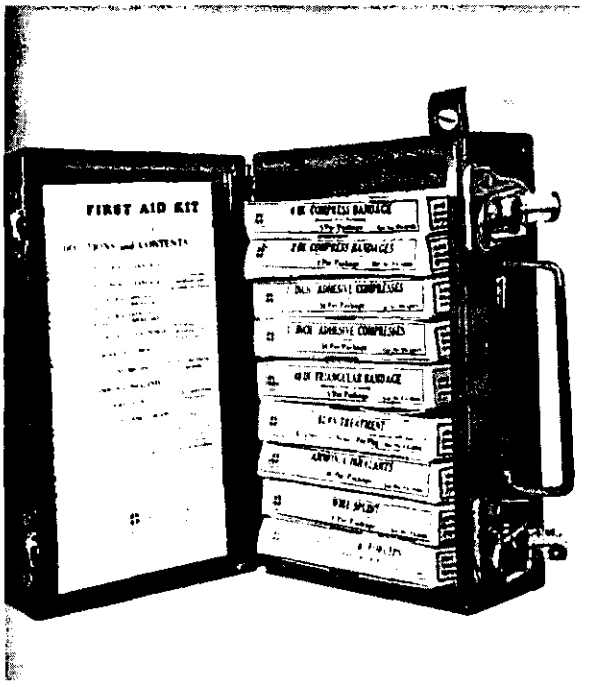
Inspect rotating or flashing beacons, if installed, for security of mounting, cleanliness, and general condition. Inspect wiring for condition and possible chafing. Check switches for proper operation. Examine connections for tightness, corrosion, and condition of insulation. Assure that fuses or circuit breakers are in good condition and operating satisfactorily.

Emergency and first aid equipment should be inspected for general condition, proper stowage and assurance that it is readily accessible. Assure that all equipment is secured so that it cannot inadvertently interfere with the controls. The first aid kit should be checked to determine the condition and sufficiency of its contents.

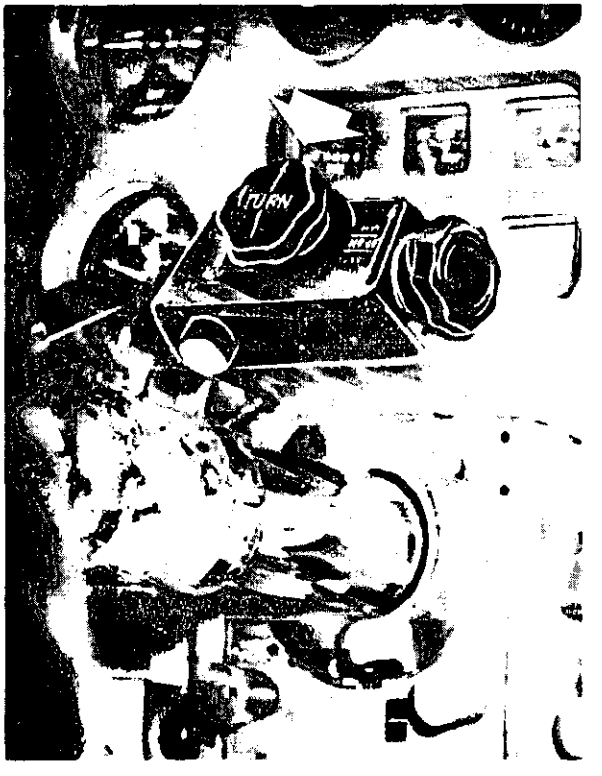
Parachutes, life rafts, flares, and the like should be inspected by qualified personnel in accordance with the manufacturer's recommendations and within applicable prescribed time periods.

Inspect the autopilot system, if installed, for general condition, security of attachment, and for obvious defects. Functional checks should be performed in accordance with the manufacturer's instructions.

• All noted defects or discrepancies should be referred to an approved repair facility.

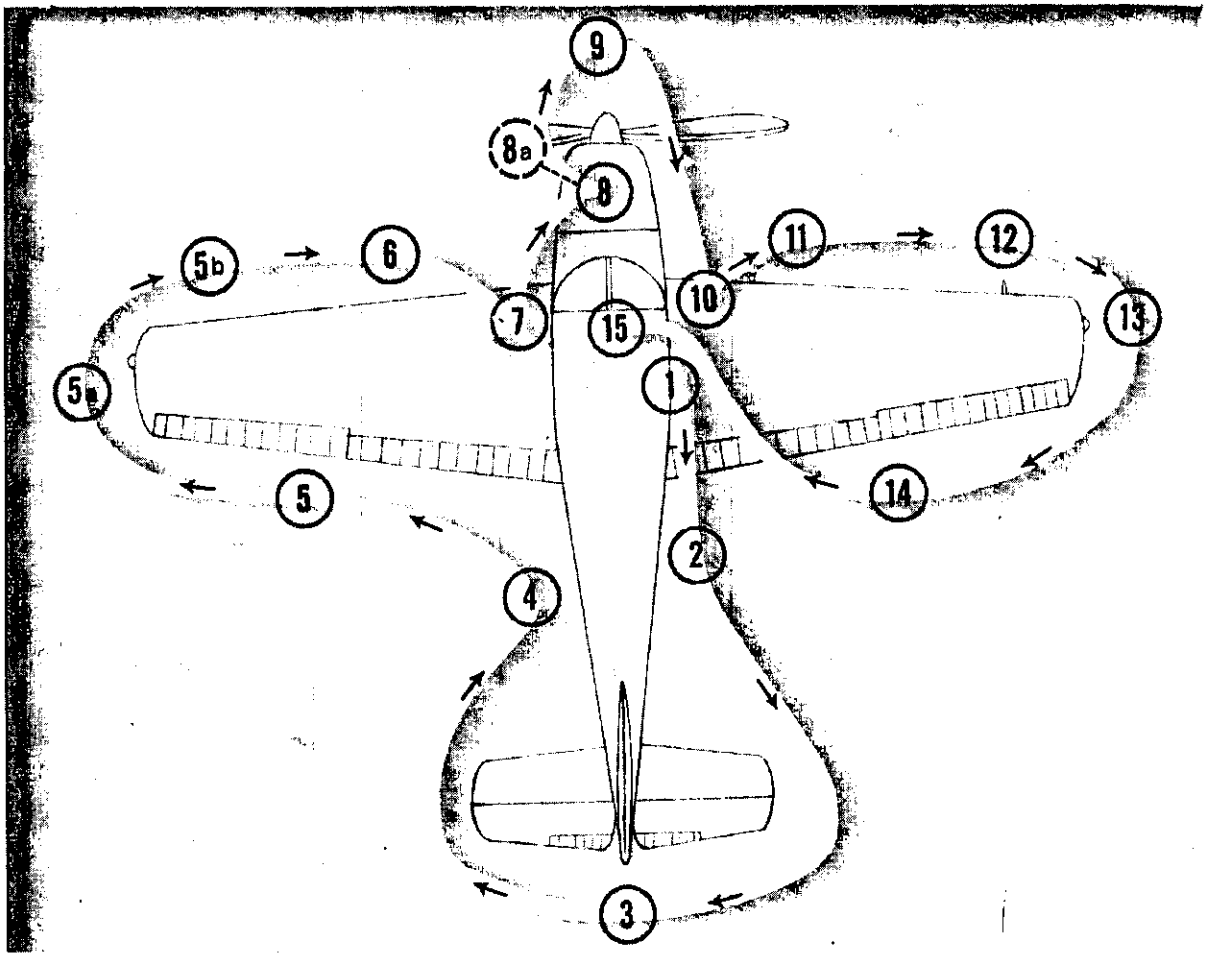


Typical first aid kit.



Autopilot control panel.

INSPECTION CHART — Preflight Inspection



Section 10. PREFLIGHT INSPECTION

This inspection guide is a practicable inspection checklist on almost any single-engine or light twin-engine aircraft, *provided* it is modified to suit the airplane type and the manufacturer's recommendations. The circled numbers on the inspection chart correspond to the numbers indicated on the itemized list. By following the numerically indicated route, as indicated by the arrows on the inspection chart, an effective and organized preflight inspection can be accomplished.

Before entering the airplane

Stand off and observe the general overall appearance of the airplane for obvious defects and discrepancies.

1. Cockpit/Cabin:
   - Battery and ignition switches—"OFF."
   - Control locks—"REMOVE."
   - Landing gear switch—gear "DOWN" position.
2. Fuselage:
   - Baggage compartment—contents secure and door locked.
   - Airspeed static source—free from obstructions.
   - Condition of covering—missing or loose rivets, cracks, tears in fabric, etc.
   - Anticollision and navigation lights—condition and security
3. Empennage:
   - Deicer boots—condition and security.
   - Control surface locks—"REMOVE."
   - Fixed and movable control surfaces—dents, cracks, excess play, hinge pins and bolts for security and condition.
   - Tailwheel—spring, steering arms and chains, tire inflation, and condition.
   - Lights—navigation and anticollision lights for condition and security.
4. Fuselage:
   - Same as item 2.
5. Wing:
   - Control surface locks—"REMOVE."
   - Control surfaces, including flaps—dents, cracks, excess play, hinge pins and bolts for security and condition.
   - General condition of wings and covering—torn fabric, bulges or wrinkles, loose or missing rivets, "oil cans," etc.

5a. Wing tip and navigation light—security and damage.

5b. Deicer boots—general condition and security.

Landing light—condition, cleanliness, and security.

Stall warning vane—freedom of movement. Prior to inspection turn master switch "ON" so that stall warning signal can be checked when vane is deflected.

6. Landing gear:
   - Wheels and brakes—condition and security, indications of fluid leakage at fittings, fluid lines and adjacent area.
   - Tires—cuts, bruises, excessive wear, and proper inflation.
   - Oleos and shock struts—cleanliness and proper inflation.
   - Shock cords—general condition.
   - Wheel fairing—general condition and security. On streamline wheel fairing, look inside for accumulation of mud, ice, etc.
   - Limit and position switches—security, cleanliness, and condition.
   - Ground safety locks—"REMOVE."
7. Fuel tank:
   - Fuel quantity in tank.
   - Fuel tank filler cap and fairing covers—secure.
   - Fuel tank vents—obstructions.
   - When fuel tank is equipped with a quick or snap-type drain valve, drain a sufficient amount of fuel into a container to check for the presence of water and sediment.
8. Engine:
   - Engine oil quantity—secure filler cap.
   - General condition and evidence of fuel and oil leaks.
   - Cowling, access doors, and cowl flaps—condition and security.
   - Carburetor filter—cleanliness and security.
   - Drain a sufficient quantity of fuel from the main fuel sump drain to determine that there is no water or sediment remaining in the system.

8a. Nose landing gear:
- Wheel and tire—cuts, bruises, excessive wear, and proper inflation.
- Oleo and shock strut—proper inflation and cleanliness.
- Wheel well and fairing—general condition and security.
- Limit and position switches—cleanliness, condition, and security.
- Ground safety lock—"REMOVE."

9. Propeller:
- Propeller and spinner—security, oil leakage, and condition. Be particularly observant for deep nicks and scratches.
- Assure that ground area under propeller is free of loose stones, cinders, etc.

10. Fuel tank:
- Same as item 7.

11. Landing gear:
- Same as item 6.

12. Pitot:
- Pitot cover—"REMOVE."
- Pitot and static ports—remove obstructions.
- General condition and alignment.

13. Same as item 5a.

14. Wing:
- Same as item 5.

15. Cockpit:
- Cleanliness and loose articles.
- Windshield and windows—obvious defects and cleanliness.
- Safety belt and shoulder harness—condition and security.
- Adjust rudder pedals so full rudder travel may be assured.
- Parking brake—"SET."
- Landing gear and flap switches or levers in proper position.
- Check all switches and controls.
- Trim tabs—"SET."
- Pilot's seat—"LOCKED."

Ground runup and functional check

It is desirable to have the airplane headed into the wind.

- Navigation and communication equipment—"OFF."
- Fuel tank selector valve—"ON."
- Brakes—"ON."
- Start engine in accordance with manufacturer's recommended procedure.
- Check all instruments for proper operation and indication.
- Check all powerplant controls.
  - At idle r.p.m., momentarily switch magnetos to "OFF" and check for proper "ground." If the engine continues to operate after the switch is turned to "OFF," it indicates a faulty ground circuit between the magneto and switch and should be corrected before further engine operation.
- Check flight controls, including flaps, for free and smooth operation in proper direction.
- Check radio receiver and tune to proper frequency.
- Set altimeter and clock.

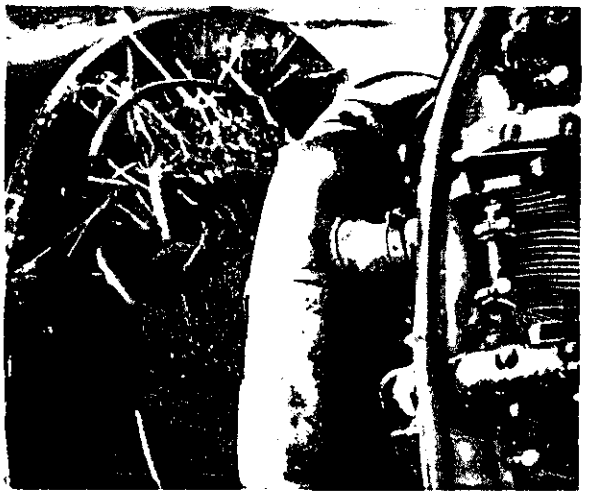
CAUTION

Many aircraft engines are air pressure cooled and depend on the forward speed of the aircraft to maintain proper cooling. Therefore, particular care is necessary when operating these engines on the ground. To prevent overheating, it is recommended that the following precautions be followed:

- Avoid prolonged idling at low r.p.m., as this practice may result in fouled spark plugs.
- As a rule-of-thumb, limit ground running to 4 minutes in cold weather and to 2 minutes at temperatures above 70° F. (21° C.).
- Take off as soon as possible after the ground runup has been completed.

After storage

A thorough inspection is recommended for aircraft that have been tied down or stored for an extensive period of time. Inactive aircraft are frequently used for nesting by insects and animals. Birds' nests in air intake scoops impair airflow, resulting in excessively rich mixtures and may cause engine stoppage. Nests lodged between engine cylinders and engine baffles cause overheating, preignition and



Bird's nest between firewall and exhaust manifold.

detonation. Insect nests obstructing fuel tank vents cause lean mixtures and fuel starvation. Mice remove rib stitching, making wings unsafe. Excretions from rodents are highly corrosive to aluminum alloy metals and harmful to fabric and wood. Deterioration or excessive weather-checking of fuel, oil, hydraulic, or induction hoses may result in leaks and faulty operation.

Be sure to inspect:

Oil coolers	—intake scoops
Carburetors	—intake screens and passages
Fuel tank vents	—free of obstructions
Pitot tubes	—free of obstructions
Fuselage	—interior and baggage areas
Wings	—interior of wings and control surfaces
Static vents	—free of obstructions

Cold weather

Aircraft having fuel tank caps installed flush with the wing upper surface are susceptible to collecting water in the filler overflow well. This water may freeze during cold weather operations, resulting in blockage of the fuel tank vent and engine failure. Partial obstruction of the vent may cause erratic engine operation and loss of power. In the case of aircraft using engine-driven fuel pumps, if the vent is blocked, the tank may collapse causing structural damage.

Check carburetor air scoop for obstructions and open the drain. Water accumulation in the air scoop may freeze and the engine will not develop full power on takeoff. Check carburetor air filter screens for obstructions to airflow from ice and snow accumulation.

Drain fuel tank sumps regularly. Water can form in the fuel tank due to condensation from rapid and extreme temperature changes and may freeze. This can result in restricted fuel flow and cracked lines and fuel strainer bowls.

Check for ice accumulation in the rear section of the fuselage and inside of the wings and control surfaces. Blowing and drifting snow may seep into the fuselage, wings, and control surfaces, eventually melting and accumulating in a low point where it may ultimately freeze. The weight of this ice may be great enough to seriously impair safe flight characteristics. Make sure that all frost, snow, and ice are removed from the aircraft, especially from the top of wings and other airfoil surfaces.

Check for proper operation of oil cooler shutters or use of covers as specified by the aircraft manufacturer. Determine that the proper grade of oil, as recommended by the engine manufacturer, is used.

U.S. GOVERNMENT PRINTING OFFICE : 1964 O—747-603