SRINIVASAN ENGINEERING COLLEGE

PERAMBALUR

DEPARTMENT OF AERONAUTICAL ENGINEERING

AE-2405 AIRCRAFT SYSTEMS LABORATORY MANUAL

Prepared by

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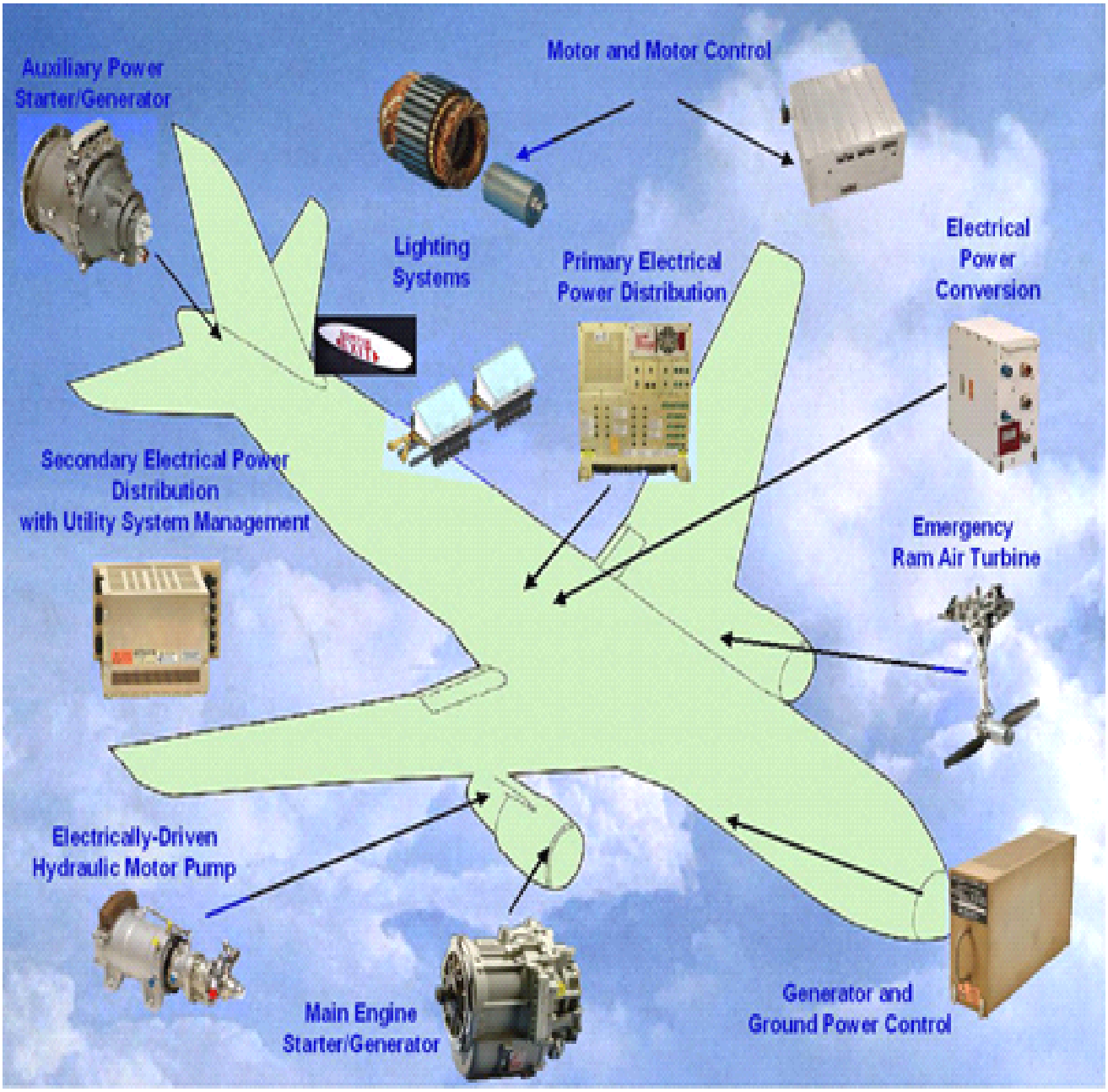
AE-2405 AIRCRAFT SYSTEMS LABORATORY



LIST OF EXPERIMENTS

INTRODUCTION TO AIRCRAFT SYSTEM

An aeronautical engineer must have a solid foundation in basics of A/C System, the principle of cooling and sound knowledge of the way the principle is applied to various systems used in the A/C. The various systems that exist in aircrafts are as follows

- Hydraulic System
- Aircraft Oxygen System
- Pneumatic System
- Air-conditioning and Pressurization System
- Electrical System
- Engine oil & Fuel System
- Aircraft Instrument System
- Ice and rain protection system
- Fire protection and smoke detection system
- Leak and Waste system
- Aircraft weapon (Rocket, Gun, Missiles, Bomb& Ejection system)
- Communication and navigation system
- Propulsion system

Though the systems are used to operate the various counter and components, they require day to day check, repair & examination for smooth and proper function. The purpose to conduct A/C system lab is to familiarize day to day activities required to maintain airworthy condition of A/C.

AIRWORTHINESS

The continuing capability of the A/C to perform in satisfactory manner, the flight operation for which it is designed.

INSPECTION

It is the most important form of function of aviation maintenance. As the A/C gives complexity, it becomes more important to detect any possible trouble before it becomes serious. To assist this, aero engineers are provided with detail special check list and the maintenance manual for each type of A/C. The engineer has to go through maintenance manual thoroughly before attempting any kind of activity in aircraft and its components. The operations may be carried out on A/C on daily flying hours and/or cycle basis.

MAINTAINENCE

The set of action including inspection, servicing, and determination of condition required to achieve a derived outcome which restore an A/C part and equipment in serviceable condition.

OVERHAUL

Overhaul means stripping a unit and restoring it to its design performance level after replacing, reworking of parts to a given standard.

SERVICING

It means preparing the A/C for flight, includes providing the A/C with fuel and other fluid and gases but do not include any work that is maintenance.

TROUBLE SHOOT

It means to analyses and identify the malfunction.

REPAIR

It means to correct the defective condition.

MODIFICATION

It is a continuous process to improve its reliability and performance.

SERVICING SCHEDULES

Servicing on Hours/Calendar/Cycle basis, which are to be carried out on aircraft at set Hours/Calendar/Cycle basis are mentioned in the manual or A/C servicing schedule. The servicing includes examination, inspection, lubrication and removal of major components such as landing gear jacks, door locks, air-conditioning equipments; aircraft brake units wheels etc. landing gear functional test, flying control range and moment check., A/C rigging procedure, hydraulic fluid contamination test, fuel contamination test & some activities requires replacement of components.

Aircraft maintenance checks are periodical checks that have to be done on all aircraft after a certain amount of time usage. Aircrafts usually refer to as one of the following checks.

A CHECK

This is performed approximately every month. This is usually done over night. The actual occurrence of this check varies by the type, cycle or number of hours flown since the last check. The occurrence can be delayed by the aircraft if certain predetermine conditions are met.

B CHECK

This is performed in approximately 3 months.

C CHECK

This is performed every 12 to 18 months. This check puts aircraft out of service and requires plenty of space usually at the hanger and maintenance base. Schedule and occurrence has many factors. The component is described and thus varies with the A/C category and type.

D CHECK

This is the heaviest check of an A/C. This check is done approximately every 4 to 5 year. This is the check that takes the entire A/C apart for inspection. A comprehensive check, analysis Non Destructive Testing (NDT) check and complete health monitoring of the engine has to be recorded. Complete overhauling of the A/C and its components even A/C painting is also required in this process.

CONCLUSION

In order to ensure air worthiness condition of an A/C and its associated systems. Various checks/inspections within stipulated time, following the schedule show the A/C and its system are kept in fully serviceable condition at all time and in turn enhance the A/C safety. The time frame of schedules varies from A/C to A/C.

SAFETY PRECAUTIONS WHILE HANDLING AIRCRAFT

SYSTEMS AND ITS COMPONENTS

AIM

To prevent accident and damage to man and material.

OCCASIONS

Whenever required to handle the A/C and its system components and ground equipments.

AIRCRAFT

- Before caring out any work on the A/C, the respective maintenance manual is to be referred for further instructions. The necessary safety precautions are to be strictly followed.
- Before entering the cock pit of a fighter A/C, ensure that the ejection seat is in safe and all armament operating switches are in safe position and all the safely pins are in position.
- Before switching on the master battery switch ensure that the under carriage selector lever is in down position and latched and all the armament store door switches are in safe condition.
- Ensure that the wheel chocks are engaged.
- Before operating the control surface, ensure that the control locks are removed.
- Before starting the engine.
- Chocks are to be kept in front of the wheel.
- A/C brake system in serviceable.
- A serviceable fire extinguisher is available.
- Never tow an aircraft without a person inside the cockpit before towing the A/C, check the brake pressure.
- While towing the A/C never exceed the walking speed.
- Never drop any tool while working.
- While working inside the A/C, collect all the tools and space on completion of the job and ensure no items are left behind.

HYDRAULIC SYSTEM

- Always release the system pressure before removing a component from the A/C
- Never does any maintenance work on airplane with any other specified oil other than the recommended one.
- Carry out the patch test on the system to prevent the contamination of oil. This can be carried out using Millipore patch test kit.
- Never mix different grade of hydraulic oil to service the A/C.

- Blank all the ports of the removed components and the A/C pipe ends to avoid the entry of dust, dirt and foreign particles.
- Follow the necessary precautions to dismantle the hydraulic components.
- Avoid spilling of hydraulic fluid on the A/C and in and around from the A/C. If spilled it should be cleaned immediately to avoid slipping.
- Before fitting a new hydraulic component, it should be unblanked, degreased, washed and flushed.
- While fitting the non return valve and restrictors, ensure that the marked arrows are in the desired direction.

PNEUMATIC SYSTEM

- Release the system pressure before attempting a job.
- Clean all the vents of the aircraft
- On removal of components, blank all the parts of the component and the respective pipes.
- While carrying out the pressure test never exceed the given limitation
- While charging the pneumatic pressure always use the pressure regulator and safety valve. Drain the oil and water separator.
- Never handle any bottle or cylinder from its charging nozzle. Always use protective cover

OXYGEN SYSTEM

- Smoking, open flames or smokes should not be permitted while working on the oxygen system.
- Do not carry matches while handling the O2 system
- A/C must be grounded and all electrical power must be switched off.
- Keep working area and equipment free of oil, grease or any other flammable material.
- Keep the tools and clothing free of oil and grease.
- Object should not come in contact with grease or solvents as this will cause spontaneous explosions.
- Never lubricate the O2 system components except on approved compatible lubricant.
- Hand should be clean and free from oil. Do not use greasing gloves.
- A spark is not necessary to cause a fire or explosion but the chemical reaction of fuel, gas and oil combined with O2 is sufficient to develop instant combustion and cause fire and explosion.
- Never permit O2 cylinder to come in contact with electrical welding circuits and apparatus.
- Never use oxygen from cylinder without reducing the pressure through a reducing regulator and safety valves.
- Never mix other gas or compressed air is an O2 cylinder.

- Never test for pipe line leaks or flow pipe line with oxygen unless the lines are specifically made for that.

SAFETY PRECAUTIONS TO BE FOLLOWED DURING FUELLING AND DEFUELLING

- Do not operate radio, radar or any other electrical and electronic equipment except those specified.
- Ground the fuel supply unit and aircraft.
- Make sure the fuelling source contain the proper fuel grade as specified by the manufacture.
- No smoking, open flame is permitted in and around the A/C.
- It is not permitted to drop any tool while the operation is on.
- The operation should be carried out in an open or fully ventilated space.
- Do not carry out oxygen related work.

CONCLUSION

Thus the various safety precautions while handling aircraft system are studied.

EX NO: 1 **JACKING UP OF AIRCRAFT**

AIM

To jack the aircraft from its steady position

JACKING

All aircraft hydraulic jacks are either axle or airframe (tripod) jacks. These jacks use standard authorized aircraft hydraulic fluid. They have a safety bypass valve that prevents damage when a load in excess of 10 percent over the rated capacity is applied. For example, the safety valve on a 10-ton jack will bypass fluid at 11 tons of pressure.

There are many different types of aircraft jacks currently in use; however, they all fall into two groups, mechanical and hydraulic.

Mechanical Lifting Jacks

The mechanical jacks operate on a simple *'screw jack'* principle, where a ratchet mechanism is used to raise the telescopic ram by use of a square thread. These jacks are usually only used for raising small light aeroplanes, and some helicopters.

Hydraulic Lifting Jacks

The majority of aircraft lifting jacks operate on a hydraulic principle, which use the fact that oil will flow freely yet act as a solid, because it is in this context incompressible. Another advantage of using the hydraulic principle, is that a relatively small piston pump can generate a lot of pressure to move the jack ram and aircraft upwards, with only a moderate effort on the part of the operator.

OCCASION

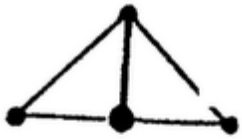
When aircraft is need to be inspected for damage to change type and during rigging check from OGCA jacking of an aircraft has to be carried out

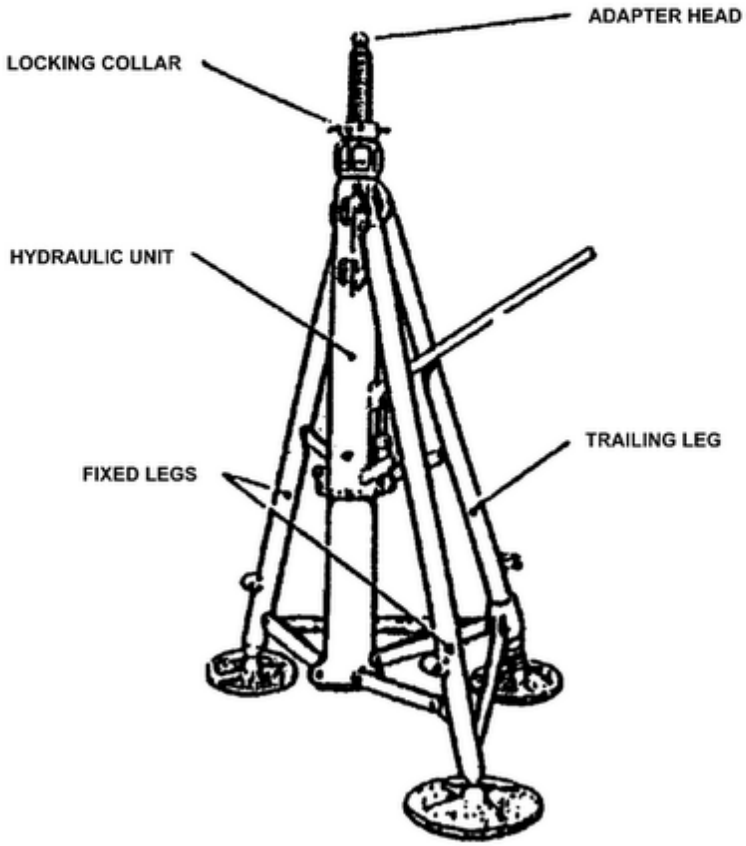
REQUIREMENTS

- Man power=3+1
- Man hours=3 hrs
- Documents of aircraft maintenance manual

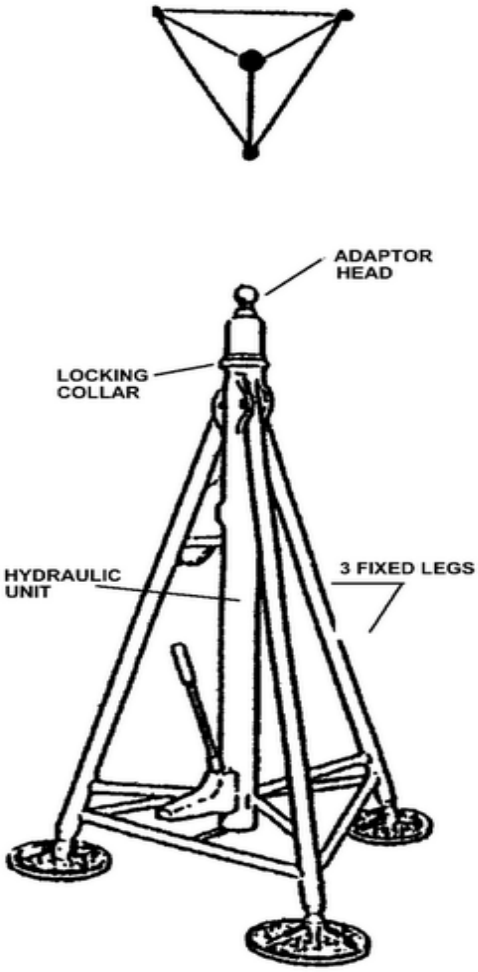
TOOLS EQUIPMENT REQUIRED

- Jacking pad
- Necessary jacks, bottle jack1, wheel chocks\\




ADAPTER HEAD
LOCKING COLLAR
HYDRAULIC UNIT
TRAILING LEG
FIXED LEGS

Tripod jack



Quradrupod jack

FIGURE 11–41. Jacking a complete aircraft.

PRECAUTIONS

- Refer aircraft maintenance manual , ensure the capacity and semi circularity of jack
- The jacking area should be oil free
- The jacking point should of which 2 at wings and one at maximum c.g location
- There should be no person inside the aircraft while jacking
- Central surfaces should be locked
- The ballasted weight should be removed before jacking
- Jack handle should not damage structure of weight
- Clearance of propeller should be ensured before jacking

PROCEDURE

Jacking Procedure-Raising

The general procedure for raising the complete aircraft on jacks is as follows:

- It differs from various aircraft and refer respective aircraft maintenance manual
- Remove the mooring
- Identify the jacking points of the aircraft by placing it in level
- After finding the jacking points place the jacks at the points.
- Place a person at the jacking point to look after the raised jacks
- All the jacks should be simultaneously raised.
- After jacking, jack locks should be checked for stability and tightened.
- The necessary inspection has to be carried out.
- If the aircraft is likely to be checked for more than 24 hrs, place the adjustable truss at specified station
- Place the displace board aircraft jacks near the aircraft

Jacking Procedure-Lowering

The general procedure for lowering the complete aircraft on jacks is as follows:

- Ensure that the landing gear control lever in the cockpit is selected to the *'Down'* position.
- Ensure that Ground Safety Locks are fitted on all Landing Gears.
- Ensure that the Brakes are released.
- Ensure that all the passenger/crew doors, the emergency exits and the cargo doors are closed and locked or fully open and locked.
- Clear the area around the aircraft of all ground support and maintenance equipment and ensure that no other work is being carried out.
- Loosen the jack Safety Locking Collars.

- Slowly operate the jacks to lower the aircraft at the same time to keeping the aircraft level until all the landing gear wheels support the full weight of the aircraft.
- Ensure that throughout the jacking operations the jack Safety Locking Collars are kept approximately 2.5 cms clear of the jack body.
- When the jack rams have *'fully'* withdrawn into their jack bodies the jacks may then be removed from under the aircraft. The removal of jacks prior to this point can be dangerous if the aircraft suddenly settles owing to any *'stiction'* in the landing gears.
- Apply the Brakes.
- Fit Wheel Chocks.
- Reinstate the relevant circuit breakers deactivated prior to raising the aircraft. Restoring the aircraft to the *'Ground Configuration'*.
- Remove warning notices from the aircraft cockpit.
- Remove Safety Barriers from around the aircraft.

RESULT

Thus the jacking of an aircraft has been carried out for further inspection

VIVA-VOCE QUESTIONS:

1. What is the procedure for jacking up?
2. What is the procedure for jacking down?
3. What is the purpose of jacks?
4. What are the types of axial jacks?
5. What is the difference between screw and hydraulic jack?
6. Define lifting bags.
7. What is meant by tripod jack?
8. What is meant by Bipod jack?
9. What is meant by quradrupod jack?

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Explain briefly about the jacking up and jacking down procedure for Cesena model aircraft?
2. Explain about various types of jacks are currently used to raising and lowering the aircraft?
3. Describe about the various types of equipment's are used to jacking up and down the aircraft?

EX NO: 2 **LEVELLING OF PUSHPAK AIRCRAFT**

AIM

To level the aircraft for inspection purpose

LEVELING

- Leveling is the process of placing an aircraft in its rigging position by means of hydraulic or screw jacks
- The rigging position is the position of the aircraft at which longitudinal and lateral axis are parallel to ground.
- Leveling means leveling the aircraft in the horizontal position for rigging. There are three types of leveling. They are as follows
    - Straight edge method
    - Grid plate method
    - Engineers transmit method

OCCASION

During replacement or renewal of major components, rigging checks, symmetry checks and as when DGCA require leveling process is carried out.

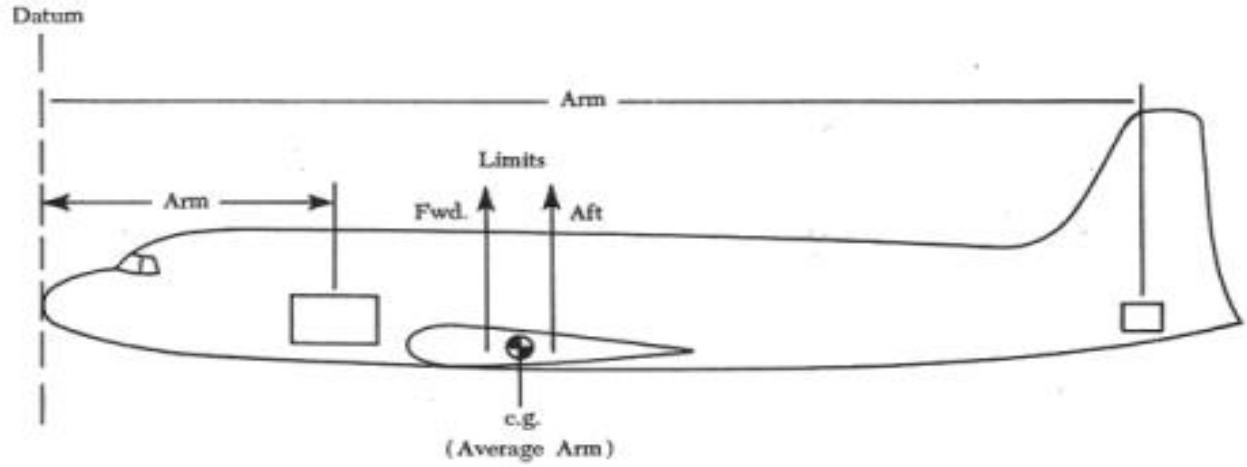


FIGURE 3–3. Datum, arm, c.g., and c.g. limits.

REQUIREMENTS

- Man hours = 3 hrs
- Man power= 3+1
- Documents= Aircraft maintenance manual

TOOLS REQUIREMENT

- Tripod screw/hydraulic jack
- Spirit level [adjustable/fixed]
- Leveling boards
- Tail trestles[fixed/adjustable]

PRECAUTION

- Observe on safety precautions for jack up
- Check the accuracy of spirit level
- Always finish leveling procedure once by checking the [longitudinal level without any adjustment]

PROCEDURE

- Place the main jack below the undercarriage near the fuselage
- Place the trestle of the specified station by lifting the tail unit
- Place the longitudinal leveling board at both side of cockpit
- Place the lateral leveling board at rear of the slats
- Place the spirit level over it and adjust main jack till the bubble of spirit level is brought in centre
- Recheck the longitudinal level
- If the bubble is in the centre in both the spirit level, the aircraft is considered to be brought into level condition
- If not, then repeat the operation from step 3 to 7

CONCLUSION

Thus the aircraft is leveled and is made ready for further checks

VIVA-VOCE QUESTIONS:

1. What is the procedure for leveling?
2. What is the function of plumb bob?
3. What is the purpose of leveling?

4. What are the types of equipment's are used for leveling?
5. What is the function of sprit level?
6. What is meant by datum plate leveling?

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Explain briefly about type of the leveling methods with suitable diagrams?
2. Explain about alignment and wing twist check of Cesena 152 model aircraft

EX NO: 3 RIGGING CHECKING UP OF AILERON DEFLECTION AND ELEVATOR DEFLECTION

AIM

To ensure the deflection angle of aileron and elevator

THEORY

"Rigging" is the term used to describe the geometric set-up of the flying surfaces of an aircraft. This includes:

1) Setting the angle of incidence of each wing and fixed stabilizing surface in relation to some defined reference line in the fuselage

2) Adjusting the surfaces for any dihedral

3) Adjusting the wings for any geometrical twist or "washout" (relative incidence of each segment of the wing)

4) Adjustment of control surfaces for the correct angular travel

5) Checking the symmetry of the aircraft, that is, for equality left/right and overall squareness or regularity

Aileron: the movement of aircraft about lateral axis is called rolling or bank. This moment ailerons are linked together by control cable. So this one aileron is down when other is up that is they function in different directions.

Elevator: The movement of aircraft about longitudinal axis is called pitching. Elevator are used to control this pitching movement. Elevators are linked together by actual cable so that both elevator are down that is move in same direction

OCCASION

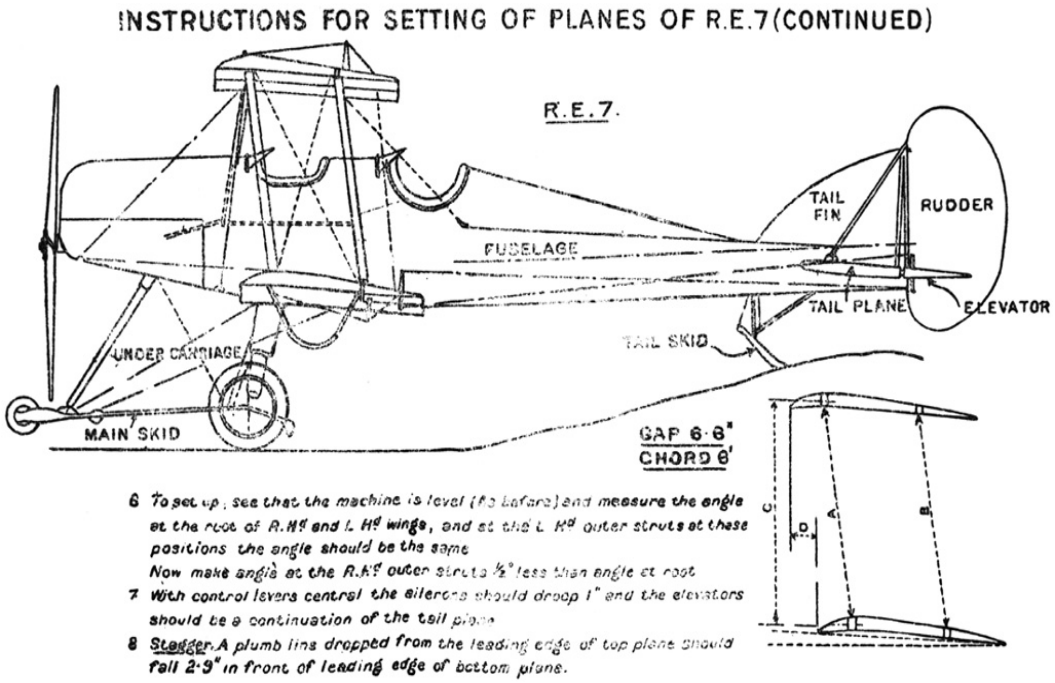
- Major servicing of aircraft
- Aircraft flies when one wing low
- As and when required by DGCA

REQUIREMENTS

- Man hours=3
- Man power=3+1
- Documents= Aircraft maintenance manual

TOOLS AND EQUIPMENTS

- Tripod
- Aircraft ladder
- Longitudinal and lateral leveling board
- Spirit level
- Plumb bob
- Measuring tape



PRECAUTIONS

FOR AILERONS

- Observe all the safety precautions for leveling]
- Accuracy of spirit level has to be checked

PROCEDURE

- Place the aircraft over the level board

- Locate the C.G point and place the leveling board and spirit level on it
- Locate the C.G point and place the leveling board and spirit level over it
- Level the aircraft as per the concerned maintenance manual
- Measure the chord length of aileron
- Measure the distance travelled by aileron in upward direction from neutral position to port side
- Take the distance from upper wing
- Measure the downward distance travelled by aileron form neutral position
- Find deflection angle from measured distance
- Check angle of deflection within specified limit

FOR ELEVATORS

- Measure the distance travelled in upward direction from neutral position to deflected position
- Take distance from upper hinge
- Measure distance travelled by elevator from neutral position
- Find the deflection angle from neutral position
- Check the angle of deflection is within the specified limit

RESULT

Thus the aileron and elevator deflection is verified and checked.

VIVA-VOCE QUESTIONS:

1. What is meant by rigging?
2. What is the purpose of Rig pin?
3. What is the purpose of rigging?
4. What are the types of axial jacks?
5. What is the purpose of tensiometer?
6. What is the purpose of throwboard?
7. What is meant by terminal swaging?
8. What is the procedure for cable maintenance

9. What is the procedure for quick disconnecting?
10. What is meant by quick disconnect?

QUESTIONS EXPECTED FROM UNIVERSITY:

11. Explain briefly about the rigging procedure for control surfaces of the aircraft?
12. Explain about various types of components are currently used for rigging of flight control systems?

EX NO: 4 AIRCRAFT SYMMETRY CHECKS

AIM

To check the symmetry of aircraft

SYMMETRY CHECK

A symmetry check is an inspection to see how the aircraft's individual components are positioned in relationship to each other.

METHOD:1

By means of direct measuring with tape

MEHTOD:2

By dropping plumb bob and marking and measuring method

OCCASION

- On assemble/erection of new aircraft
- Replacement/removal of major component
- Heavy landing reports
- Followed by flight through turbulence
- Repeated smog on flight c.s
- Any modifications on aircraft which affect its performance
- As and when required by DGCA

PRECAUTIONS

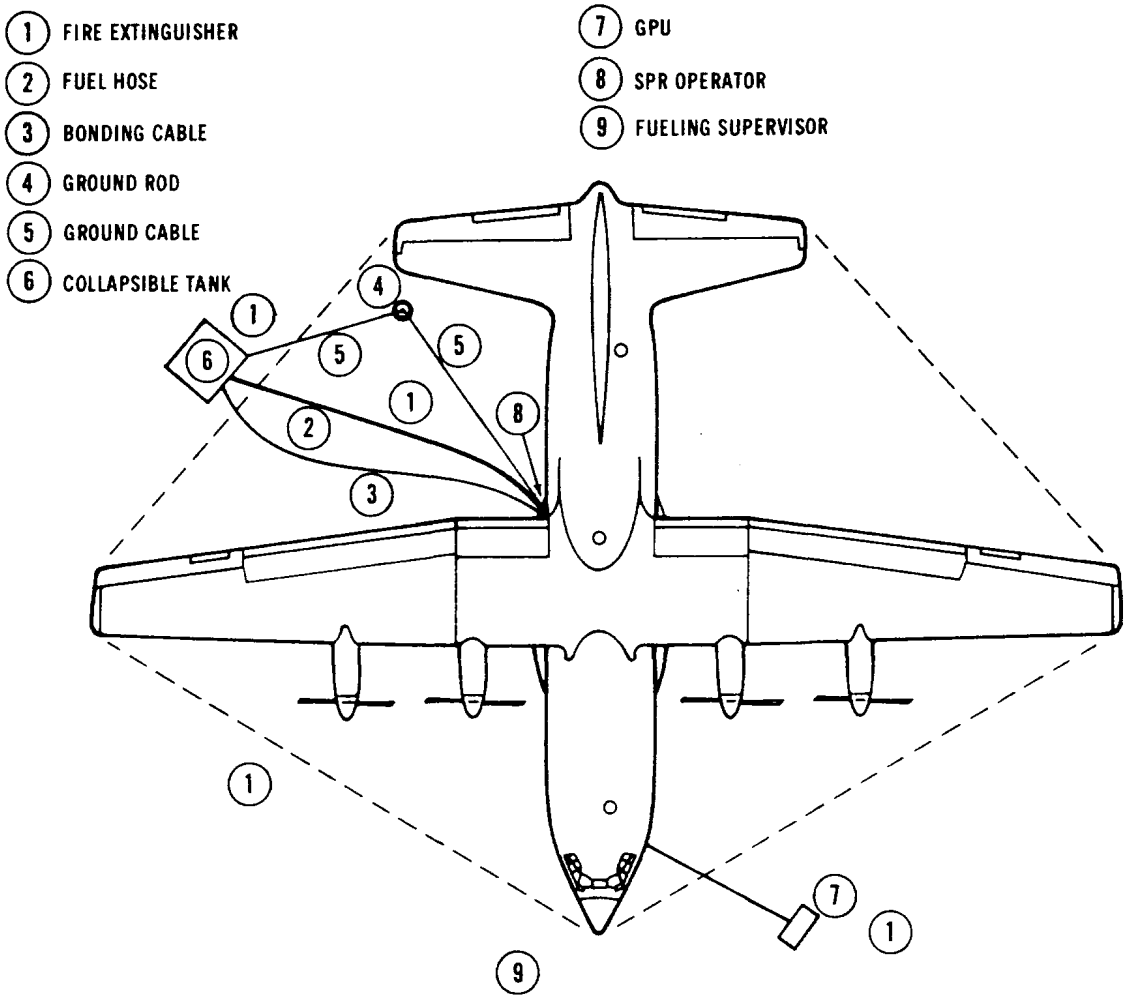
- Refer aircraft maintenance manual ensure the caution surroundings of aircraft
- The jacking area should be free
- Observe all safety precaution for leveling
- Check the accuracy of spirit level
- Always finish leveling procedure only by checking the longitudinal level

REQUIREMENT

- Working hrs=3
- Man power=3
- Document= aircraft maintenance manual and rigging check up

TOOLS USED

- Measuring tape
- Spirit level
- Plumb bob
- Leveling board
- Tripod jack
- Support jack



PROCEDURE

- Place the aircraft in rigging position
- Check the incident angle of wing

- Check the dihedral angle of main plane
- Check the sweep back angle
- Check the dihedral angle of tail plane
- Drop the plumb bob from spin centre and tail wheel centre and measure the length of aircraft
- Drop the plumb bob from either wing tips and mark it on the ground
- From fin top hinge or tail where centre drops the plumb bob and mark it
- Measure the diagonal distance
- Check the fin verticality
- Measure the spin centre to each wing tip
- Tabulate in the format given

RESULT

Above stated difference are measured and compared with the rigging chart and found with permissible limits

VIVA-VOCE QUESTIONS:

1. What is meant by symmetry check?
2. What are the equipment's are involved in symmetry check?
3. What is the purpose of symmetry check?

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Explain briefly about the symmetry check procedure for naval aircraft?

EX NO: 5 FLOW TEST TO ASSESS OF FILTER ELEMENT CLOGGING

AIM

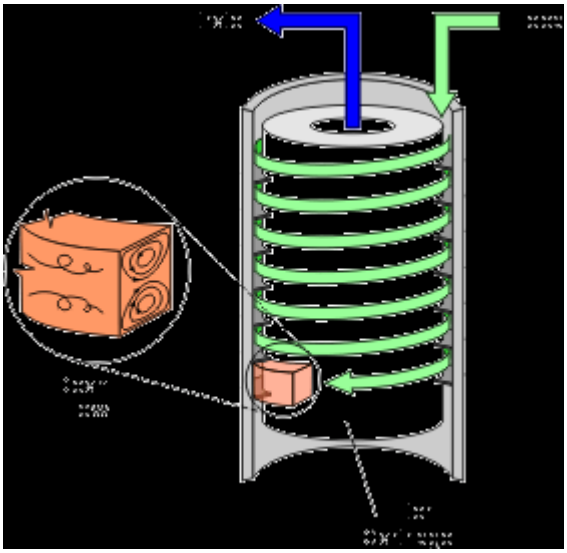
To ensure the cleanliness of the following element and for the oil a flow test is carried out in order to determine the filtering capacity of the filtering element.

OCCASION

1. Specified period intervals
2. Followed by a filters failure or snag
3. After install of new filter

PRECAUTION

1. Ensure that the filter elements are subjected to a ultrasonic cleaning before carrying out this test
2. Carryout this test only in a dust proof room condition.
3. Use hand gloves during this test for handling filter element and test equipment



PROCEDURE

1. Pour specified hydraulic oil (skydroll) up to move in the container
2. Engage the bottom plug to the filter elements bottom by pushing top
3. Engage the upper adapter on the top of the fitter element by pushing down.
4. Engage the plunger assembly to the top of adapter by screening down

5. Blank the upper part of the plunger / stem by thumb clip the plunger with the fitter fuel the upper adapter flange immerse in the oil of the container.
6. Un blank the upper part of the plunger
7. By removing the thumb-clip and simultaneously start the stop watch to note down the timing.
8. Note down the time taken for the stem to come up unlike with plunger and the timing use within 5 to 6 seconds
9. Increase of excess timing subjected the filtering element again to ultrasonic cleaning.
10. Reject the filtering elements for aircraft and it does not filter within 5-6 seconds followed by two successive ultrasonic cleaning operations.

RESULT

The subjected test is carried out and found satisfactory.

VIVA-VOCE QUESTIONS:

1. What is mean by hydraulic fluid?
2. Types of hydraulic fluid.
3. What is the size of filter elements?
4. What is mean by strainer?

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Do a flow test to assess of filter element clogging
2. Test a filter element for clogging.

EX NO: 6 "PRESSURE TEST" TO ASSESS HYDRAULIC EXTERNAL/INTERNAL LEAKAGE

AIM

To perform the pressure test on hydraulic system components to locate the internal and external leakage

HYDRAULIC LEAKAGE

Any hydraulic system will have a certain amount of leakage. Any leakage will reduce efficiency and cause power loss. Some leakage is built in (planned), some is not. Leakage may be internal, external, or both.

Internal leakage

Too much internal leakage will slow down actuators. The power loss is accompanied by the heat generated at a leakage path. In some instances, excess leakage in a valve could cause a cylinder to drift or even creep when a valve is supposedly in neutral. In the case of flow or pressure-control valves, leakage can often reduce effective control or even cause control to be lost.

Normal wear increases internal leakage, which provides larger flow paths for the leaking oil. An oil that is low in viscosity leaks more readily than a heavy oil. Therefore oil's viscosity and viscosity index are important considerations in providing or preventing internal leakage. Internal leakage also increases with pressure, just as higher pressure causes a greater flow through an orifice. Operating above the recommended pressures adds the danger of excessive internal leakage and heat generation to other possible harmful effects.

A blown or ruptured internal seal can open a large enough leakage path to divert all of a pump's delivery. When this happens, everything except the oil flow and heat generation at a leakage point can stop.

External leakage

External leakage can be hazardous, expensive, and unsightly. Faulty installation and poor maintenance are the prime causes of external leakage. Joints may leak because they were not put together properly or because shock and vibration in the lines shook them loose. Adding supports to the lines prevents this. If assembled and installed correctly, components seldom leak. However, failure to connect drain lines, excessive pressures, or contamination can cause seals to blow or be damaged, resulting in external leakage from the components.

PREVENTION

Proper installation, control of operating conditions, and proper maintenance help prevent leakage.

OCCASION

1. Specified period intervals
2. Followed by a hydraulic system failure or snag

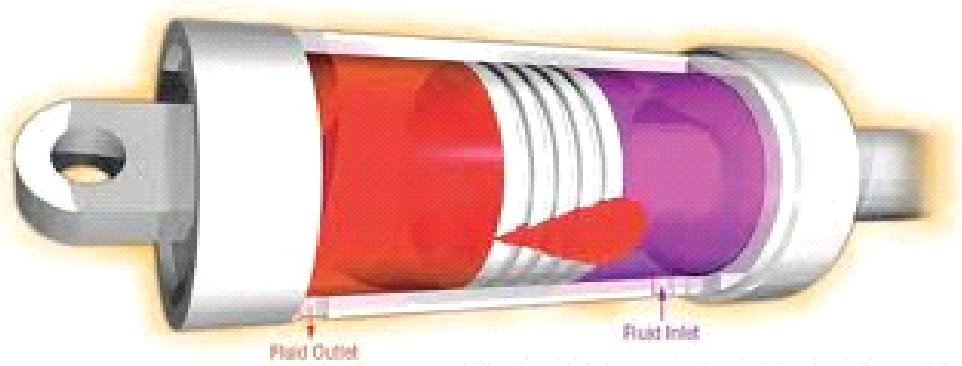


Figure 1. Excessive Internal Leakage

PROCEDURE

Internal leakage

1. Remove the swivel nut from the strainer bowl and drain the fluid completely.
2. Turn off the hydraulic pump.
3. Turn off the fluid selector valve.
4. If the valve is looking intervals, fluid with flow into the strainer bowl.

External leakage

1. Locating leaks or detest in the hydraulic system external portions involved very little time in comparisons
2. Check for strains on newly developed wet spots in the fluid lines and hoses.
3. If there is only fuel o dour that will indicating fluid leaks.
4. Carefully examine the plumbing, clamps, gaskets supports etc for fluid leaks or aircraft structure for evidence of fluid leaks.
5. Check the repaired tanks manufacturing any defects on leaks in the internal or external fluid system is potential hazard.

RESULT

Thus pressure test on hydraulic fluid system components carried out to detect with the internal and external leakage.

VIVA-VOCE QUESTIONS:

1. What is snag?
2. What is booster pump?
3. Enumerate the different types of pumps.

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Find the leakages in hydraulic system and do pressures test.

EX NO: 7 FUNCTIONAL TEST TO AGJUST OPERATING PRESSURE

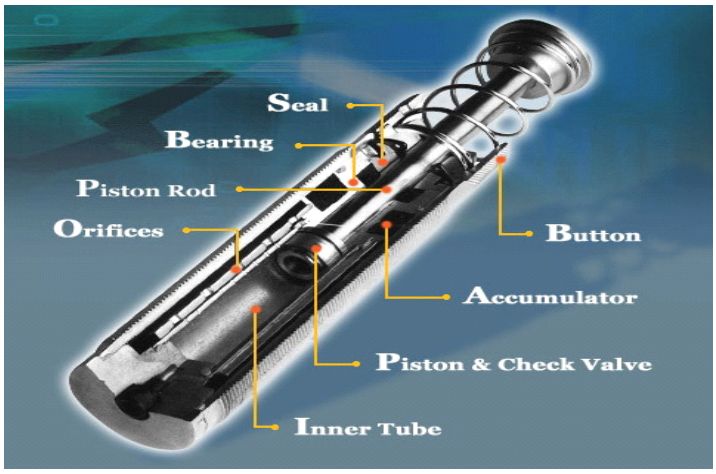
AIM

To deflecting a shock strut servicing and reinflate

THEORY

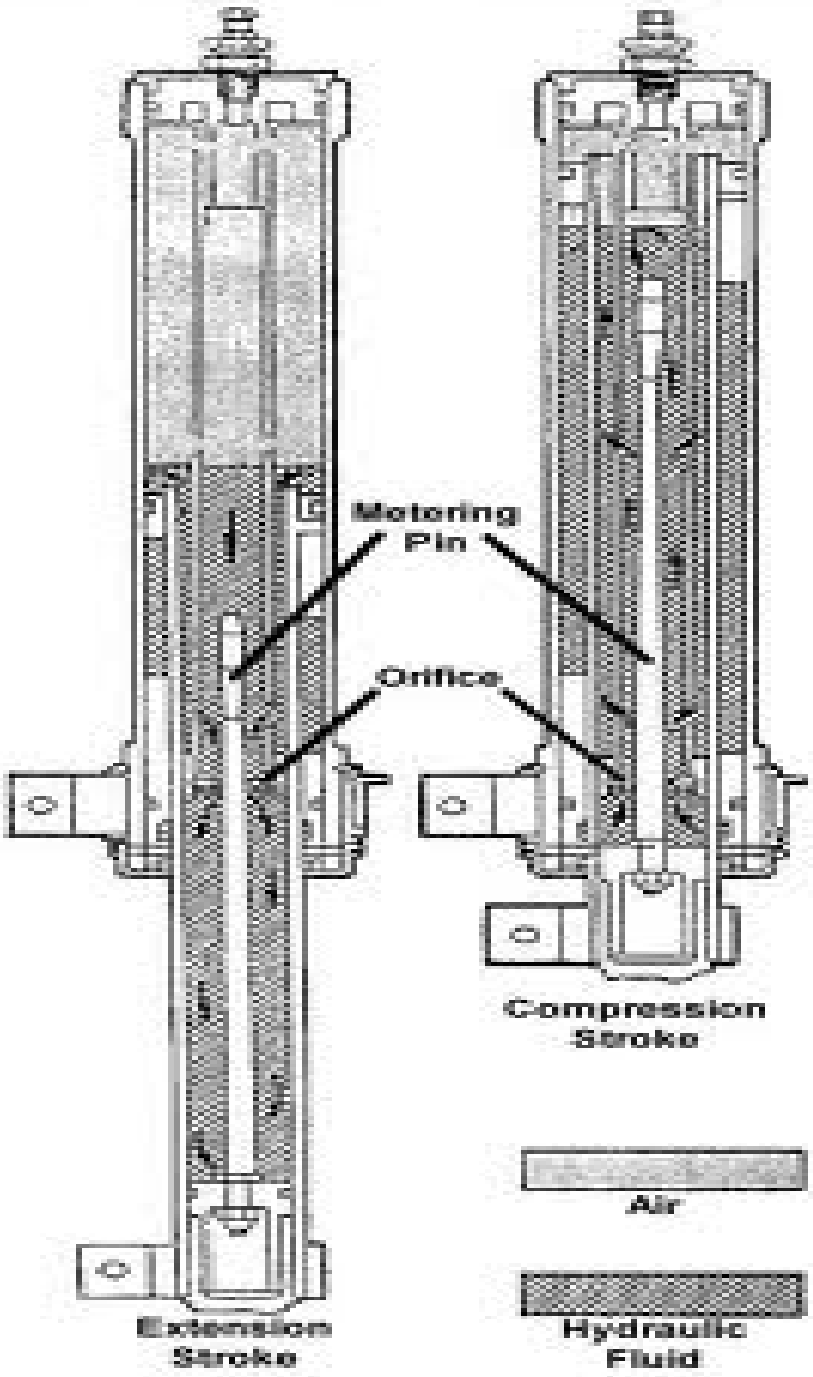
The basic weight support function of the oleo-pneumatic shock struts, which have a high efficiency under dynamic conditions both in terms of energy absorption and dissipation, is provided by a compressed cylinder of air and oil. A single-acting shock absorber, which is the most commonly used design for commercial transports. This type of shock strut absorbs energy by first forcing a chamber of oil against a chamber of dry air or nitrogen and then compressing the gas and oil. During the compression process, the oil and gas either remain separated or are mixed depending on the type of design. After the initial impact, energy is dissipated as the air pressure forces the oil back into its chamber through recoil orifices.

Although the compression orifice could be merely a hole in the orifice plate, most designs have a metering pin extending through it, and by varying the pin diameter the orifice area is varied. This variation is adjusted so that the strut load is fairly constant under dynamic loading. If this can be made constant, the gear efficiency would be 100 percent. In practice, this is never obtained and efficiencies of 80 to 90 percent are more usual. Since only the efficiency factor is of interest in the conceptual design phase, no additional discussion on the design of the metering pin will be provided.



OCCASION

1. Specified period intervals
2. Lacks in pressure
3. Failure of shock strut



PROCEDURE

1. Place the aircraft on jack position so the shock struts are in the normal ground operating system position.
2. Make sure that no person and other obstacle are cleared under the aircraft.
3. Remove the dust cap from the aircraft.
4. Check the swivel hex nut for tightness with wrench.
5. If the air valve equipped with core release the air pressure that may be trapped between the valve core and valve seat
6. Remove the valve core
7. Release the air pressure in the strut by slowly turning the swivel nut counter clockwise
8. Ensure that the shock strut compresses as the air pressure is released
9. When the strut is fully compressed the air valve assembly is removed
10. Reinstall the air valve core assembly
11. Inflate the strut using a light pressure source of any air on a shock strut, the correct amount of inflation is determine by measuring the amount of extension.
12. Shock strut should always be inflated slowly to avoid excessive heating and over inflation.
13. Tight the swivel hex nut using the torque valve specified in the applicable manufacture manual
14. Remove the light pressure airline
15. Check and install the valve cap tight valve cap finger tight.

RESULT

Thus the servicing and functional test of shock strut carried as per the manufacture instruction

VIVA-VOCE QUESTIONS:

1. Different types of shock absorber
2. What is orifice valve
3. What is the function of metering pin

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Preform the functional test on oleo pneumatic shock absorber.
2. Write the for servicing the oleo pneumatic shock absorber.

EX NO: 8 PRESSURE TEST ON FUEL SYSTEM COMPONENTS

AIM

To perform the pressure test on fuel system components to locate the internal and external leakage

THEORY:

Fuel System Components: Before doing any fuel pressure testing, it is a good idea to understand how fuel system components work and how they relate to one another. The fuel pump pumps fuel from the fuel tank to the fuel pressure regulator and fuel injectors. The fuel pressure regulator divides fuel between the pressure line and the return line. The fuel in the pressure line goes to the fuel injectors; while the fuel in their turn line is returned to the fuel tank

Fuel Tank: A large container that holds your vehicles supply of fuel.

Fuel Pump Filter: A filter that is usually located in the fuel tank. Its function is to prevent foreign particles from reaching the fuel pump. A clogged or restricted fuel pump filter can cause low fuel pressure readings. When replacing a fuel pump it is a good idea to clean or replace the fuel pump filter.

Fuel Pump: An electric motor that pumps fuel into the fuel system at a constant pressure. It is mounted in the fuel tank or on the frame. Some vehicles have more than one fuel pump.

Return Line: Path way for excess fuel to return to the fuel tank.

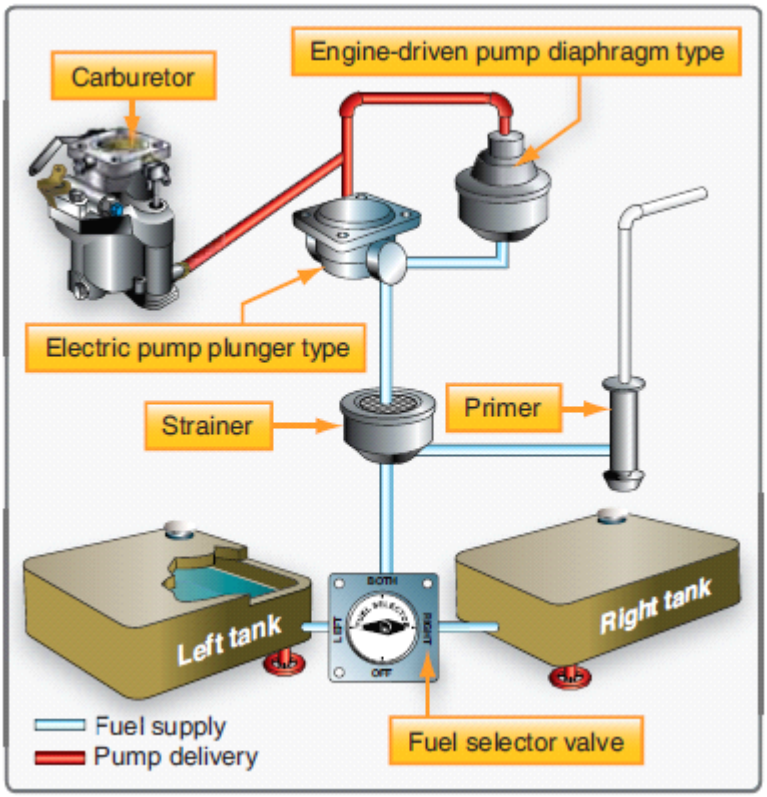
Pressure Line: A pressurized fuel line that carries fuel from the fuel tank to the fuel injectors.

Fuel Filter: A filter that is located in-line with the pressure line. Its function is to prevent foreign particles from reaching the fuel injectors. A clogged or restricted fuel filter can also cause low fuel pressure readings. This is the only fuel system component that requires periodic replacement. Refer to vehicle owner's manual for replacement interval.

Fuel Pressure Regulator: The fuel pressure regulator is connected across the pressure line and return line. It contains a spring loaded valve assembly that opens to allow fuel to move into the return line, when the pressure line fuel pressure is exceeded. It is used to keep a constant fuel pressure drop across the fuel injectors. Some fuel pressure regulators have a vacuum port so fuel pressure can be adjusted based on engine load. These are commonly called vacuum actuated

(compensated) fuel pressure regulators. A leaking fuel pressure regulator can cause low fuel pressure readings and hard starting problems.

Fuel Injectors: A precision valve that is controlled by a solenoid. Fuel injection is controlled by the amount of fuel pressure and the size and duration of the valve opening. Fuel injectors contain a filter used to prevent very small particles from **clogging** the valve. Leaking fuel injectors will cause fuel pressure to slowly decrease when the ignition key is on and engine is off.



PREVENTION

Proper installation, control of operating conditions, and proper maintenance help prevent leakage.

OCCASION

1. Specified period intervals
2. Followed by a fuel system failure or snag

PROCEDURE

Internal leakage

- Remove the swivel nut from the strainer bowl and drain the fuel completely.

- Turn off the fuel engine booster pump.
- Turn off the fuel selector valve.
- If the valve is looking intervals, fuel with flow into the strainer bowl.

External leakage

- Locating leaks or detest in the fuel system external portions involved very little time in comparisons
- Check for strains on newly developed wet spots in the fuel lines and hoses.
- If there is only fuel odour that will indicating fuel leaks.
- Carefully examine the plumbing, clamps, gaskets supports etc for fuel leaks or aircraft structure for evidence of fuel leaks.
- Check the repaired tanks manufacturing any defects on leaks in the internal or external fuel system is potential hazard.

RESULT

Thus pressure test on fuel system components carried out to detect with the internal and external leakage.

VIVA-VOCE QUESTIONS:

1. Different fuel system.
2. What is clogging?
3. What is function of pressure regulator?

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Explain briefly about the fuel system pressure test.
2. Write a procedure for pressure test on fuel system.

EX NO: 9 BRAKE TORQUE LOAD TEST

AIM

To prevent the brake failure during brake application and to keep the brake system always in serviceable condition

THEORY

- The aircraft wheel brakes are designed to provide slowing down of aircraft on touchdown and totally to stop the aircraft
- It holds the aircraft while parking and during ground running of engine
- The brake unit may be shoe type, disc type or multi disc type
- By proper maintenance of brake unit the maximum flight accidents may be prevented
- If the air is found in the hydraulic brake system brake will not be effective
- So the presence of air is found in the hydraulic brake system is to be expelled from system is called BLEEDING OF SYSTEM
- If air is not removed the brakes system will be spongy
- To avoid that brake bleeding has to be carried out of regular intervals

OCCASION

- On any periodic servicing as per lay down in servicing schedule
- If any hydraulic brake detected from piston assembly of brake unit
- Whenever pilot reports that the brake unit is slugging/spongy action of brake pedals
- At the time of brake pipe renewal and topping up of brake reservoir

REQUIREMENTS

- Man hour=3 hrs
- Man power=3+1
- Documents = aircraft servicing form, aircraft maintenance manual

EQUIPMENTS/TOOLS

- Tripod screw/hydraulic or bottle jack
- Bleeding hose
- Clean container with specified hydraulic oil
- Hand gloves

SAFETY PRECAUTION

- Take proper precaution of jacking up of aircraft
- Clean the serviceability of jacks
- Jacking sufficient hydraulic oil in a cleaned container
- Bleeding should be contained until no more oil bubbles are expelled from the system and fin brake pedal is obtained

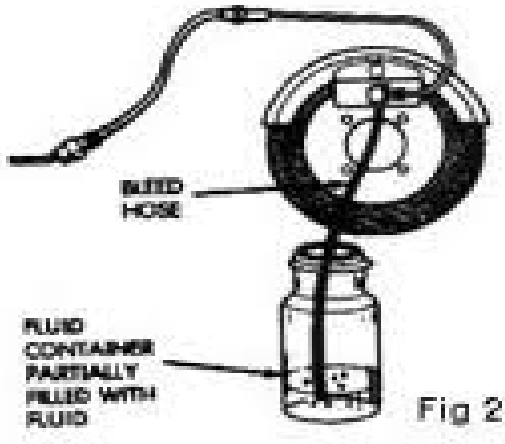


Fig 23

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PROCEDURE

- There are two methods of bleeding the brake system, gravity and pressure methods. gravity method is described below
- Jack up the aircraft with all necessary conditions
- Remove the bleeder screw from the bleeding point on the brake unit, by cutting the locking wire
- Connect one end of brake hose to bleeding point and other end of hose immerse in to the specified oil in small container
- The fluid is then forced from the system of operating the brake pedals
- Watch for the bubbles from oil which comes out from brake system through hose
- Bleeding should be contained till hydraulic oil comes out without air bubbles
- Fill the brake master cylinder with fresh hydraulic oil which has lost during this process
- Apply the brake several times and check for any problem in brake system
- Wire lock the bleeder screw

- Lower the aircraft by taking proper precaution
- Make necessary entry in the aircraft servicing form/log book

RESULT

The aircraft brake system bleeding is carried out and found satisfactory.

VIVA-VOCE QUESTIONS:

1. Enumerate different types of brake system used in aircraft.
2. What is bleeding?
3. What is mean by disk brake?
4. Differentiate between disk brake and drum brake.

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Write a procedure for find a bleeding in brake system.
2. Describe the brake load torque test.

EX NO: 10 MAINTENANCE AND RECTIFICATION OF SNAG IN HYDRAULIC AND FUEL SYSTEMS

AIM

To study the trouble shooting procedure on aircraft hydraulic system

HYDRAULIC SYSTEM MAINTENANCE PRACTICES

The maintenance of hydraulic and pneumatic systems should be performed in accordance with the aircraft manufacturer's instructions. The following is a summary of general practices followed when dealing with hydraulic and pneumatic systems.

Service

The servicing of hydraulic and pneumatic systems should be performed at the interval is specified by the manufacturer. Some components, such as hydraulic reservoirs, have servicing information adjacent to the component. When servicing a hydraulic reservoir, make certain to use the correct type of fluid. Hydraulic fluid type can be identified by color and smell; however, it is good practice to take fluid from the original marked container and then to check the fluid by color and smell for verification. Fluid containers should always be closed, except when fluid is being removed.

Inspections

Hydraulic and pneumatic systems are inspected for leakage, worn or damaged tubing, worn or damaged hoses, wear of moving parts, and security of mounting for all units, safe tying, and any other condition specified by the maintenance manual. A complete inspection includes considering the age, cure date, stiffness of the hose, and an operational check of all subsystems.

1. Leakage from any stationary connection in a system is not permitted, and if found, it should be repaired. A small amount of fluid seepage may be permitted on actuator piston rods and rotating shafts. In a hydraulic system, a thin film of fluid in these areas indicates that the seals are being properly lubricated. When a limited amount of leakage is allowed at any point, it is usually specified in the appropriate manual.
2. Tubing should not be nicked, cut, dented, collapsed, or twisted beyond approved limits. The identification markings or lines on a flexible hose will show whether the hose has been twisted.
3. All connections and fittings associated with moving units must be examined for play evidencing wear. Such units should be in an unpressurized condition when they are checked for wear.

4. Accumulators must be checked for leakage, air or gas preload, and position. If the accumulator is equipped with a pressure gauge, the preload can be read directly.
5. An operational check of the system can be performed using the engine-driven pump, an electrically-operated auxiliary pump (if such a pump is included in the system), or a ground test unit. The entire system and each subsystem should be checked for smooth operation, unusual noises, and speed of operation for each unit. The pressure section of the system should be checked with no subsystems to see that pressure holds for the required time without the pump supplying the system. System pressure should be observed during operation of each subsystem to ensure that the engine-driven pump maintains the required pressure.

S.no	PROBLEM	CAUSE	REMEDY
1.	Lack of hydraulic pressure in a system	Defective pump Deflective relief valve Pressure regulator defective Lack of hydraulic fluid	Replace the pump Fill with fluid
2.	System failed to hold pressure	Defective pressure regulator (or) Unloading valve Leaking relief valve (or) check valve	Replace the valve
3.	High pressure in a system	Defective (or) improperly adjusted obstruction in a line or control unit	Set the required pressure in regulator and remove the obstruction.
4.	Usually noise in a hydraulic systems such as chattering and bearing	Air (or) contamination in the system Faulty pressure regulator Lack of proper accumulator	Remove contamination Replace with new one Check fluid level in accumulator
5.	Grabbing brake	Oil or some other foreign matter on disk and lining	Clean the disk Replace the disk or drum Replace the lining

6.	Failing brake	Brake have been over heated and things burned	Remove the air Replace the spring Change the new valve
7.	Dragging brake	Air in hydraulic Broken down or weak return spring Defective valves	Remove the air Replace the spring Change the new valve

RESULT

Thus a different snag on aircraft hydraulic system and their cause and remedy is familiarized.

VIVA-VOCE QUESTIONS:

1. What is Engine Alignment?
2. What is inspection?
3. How often the hydraulic system services?
4. What is AMM?

QUESTIONS EXPECTED FROM UNIVERSITY:

1. Describe the different snags and problem occurs in hydraulic system and its rectifications.

THANK YOU