

PHASE 8

SAFETY PRECAUTIONS



SAFETY PRECAUTIONS  
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## SAFETY PRECAUTIONS

### GENERAL

#### PRECAUTIONS TO BE TAKEN IN OR AROUND AIRCRAFT

- 1 Extreme care is to be taken in crossing the tarmac or the tarmac or the apron between hangers. The sound of approaching aircraft is drowned by nearby engines running up, and warning therefore, can only be visual. Audible warning in such cases must not be relied on. Aircraft manoeuvrability and pilot's vision are limited when taxiing, and this must be taken into consideration by personnel walking in hanger areas.
- 2 When work is being done at a height, the ladders, trestles, or platforms employed are to be fixed firmly and tools placed in such a manner that there is no possibility of their dropping and causing injury or damage. If necessary, strong cords are to be attached to tools and to a fixed object or to the operator's wrist.
- 3 Only the prescribed method for entering and leaving an aircraft should be used. The use of improper foot rests or hand holds may result in slipping or falling, with accompany injuries.
- 4 Before testing the operation of ailerons, elevators, or rudders from cockpit, ensure that personnel in the vicinity have been warned, and that no equipment is in the line of travel of these components.
- 5 Do not operate or tamper with switches or controls with which you are unfamiliar and which are not in your line of duty, as components may be set in motion and cause death or injury to yourself or other personnel in the area or damage to the aircraft. Specifically, when testing the operation of components such as undercarriages, bomb-bay doors, flaps, speed of dive brakes, make certain that personnel are completely out of range, and have been warned to stay clear.

#### PRECAUTIONS TO BE TAKEN IN HANGERS, SHOPS, ETC

- 6 Running, throwing things, scuffling, and playing in workshops and hangers is very dangerous to both personnel and aircraft, and is not to be permitted. Para 5, regarding the operating or tampering with switches or controls, applies equally to equipment in hangers, workshops or other sections.
- 7 Arrange materials carefully and securely. Do not create a possible hazard by piling or placing objects or materials near machines. When it is necessary to leave any equipment projecting into a passageway it is to be made plainly visible by means of some noticeable material, such as a white or red flag or paper. Similar precautions are to be taken when a tie-rod to any other object is projecting at any level.



8 Floors are to be kept clean of oil, short pieces of round stock, cable, wire, nails, etc. Serious falls may result through neglect of this precaution. Ropes, inspection lamp leads, and air hoses in actual use are to be placed so that there is no possibility of anyone falling over them.

9 All scrap metal, wood shavings, glass, papers, oily rags, etc., are to be placed in separate covered metal containers.

10 Red clearance lines are to be painted about machines, fire extinguishers, doors and passageways, and these areas kept clear and free of obstruction.

#### MISCELLANEOUS

11 Ladders are to be of proper size. Wirebound or metal ladders are not to be used if any damage of an electrical contact exists.

12 In placing ladders the base is to be approximately one-fourth of the ladder's length away from the wall against which the ladder is leaning. Ensure that the footing is firm and that the steps or rungs are secured and free from oil or grease. The use of ladders and platform ladders in winter weather create hazardous working conditions due to the accumulation of ice and snow on ladder rungs and shoes of personnel. Damage to public property and injuries to personnel have resulted from the lack of suitable anti-skid surfaces on many types of ladder rungs. It is recommended that the following anti-skid devices be applied as follows by units using various types of ladders.

- (a) Multiple row of spot welds, spaced at a 1" pitch or less over the foot bearing surface of the rungs.
- (b) A liberal coating of "Walkway Compound, Rough Type" (RCAF Ref. 33A/493) applied over the upper and front faces of the rungs.

13 Improper lifting of heavy objects may cause hernia (rupture) The correct method of lifting to avoid strains is to bend the knees, keep the body erect, then push upwards with the leg muscles. Get help if necessary.

14 Suitable hand protection is to be worn when handling types of materials liable to cause burns, cuts or silvers. Such protection is not to be worn by personnel working around machinery, unless specifically approved by the CTECSO.

15 Personnel are to remove finger rings before commencing any servicing operation on aircraft or ME or the operation of any machine where there may be danger of rings being caught by moving or protruding parts. Serious finger injuries have resulted from the neglect of this precaution.

16 Care is to be taken also regarding loose articles of clothing such as ties, caps, etc., when working around ground handling or shop equipment. Such items should be removed to ensure they are not caught in any moving parts.

17 There is a danger of split pin ends flying out when cut, after replacement, with possible eye injury to those in the immediate vicinity. When cutting the ends off split pins, locking wire, etc., personnel are to use the disengaged hand as a shield and catch the severed ends.

#### DISPOSAL OF FLUORESCENT LAMPS

18 The breaking of fluorescent lamps, which is usually necessary in disposing of burned out lamps, creates a hazard from flying glass and from dust given off from the lamps, which in some cases be toxic. The following precautions are therefore to be taken when it is necessary to break fluorescent lamps.

- (a) Goggles will be worn and care taken to avoid injury from flying glass.
- (b) All tubes will be broken out of doors in a waste disposal area, or in a waste container.
- (c) Care must be taken to avoid breathing dust and vapours which may be evolved. Where a large number of fluorescent lamps are to be broken, the operator will be supplied with and required to wear a respirator approved for toxic dusts.

SAFETY PRECAUTIONS

STATION SAFETY COUNCIL

1 It has been found that the majority of "lost time" accidents are due to human errors or avoidable hazards. A reasonable amount of care on the part of all personnel, and the safety training given by a council concerned with such matters, should result in a marked decrease in the number of accidents, and in man-hours lost.

2 A Station Safety Council is to be formed at all RCAF Stations and units. Council is to consist of the CO as chairman (or his designated representative when he cannot attend) and as applicable, members as follows:-

- (a) Chief Technical Services Officer
- (b) Chief Administrative Officer
- (c) Senior Aeronautical Engineering Officer
- (d) Vehicle and Marine Engineering Officer
- (e) Station Armament Officer
- (f) Station Construction Engineering Officer
- (g) Station Telecommunication Officer
- (h) Station Senior Supply Officer
- (j) Station Medical Officer
- (k) Station Recreation Officer
- (m) Station Security Officer
- (n) Principal of Department's School

NOTE

Additional members are to be added by the chairman as necessary to provide for adequate representation from all sections of the station. Senior NCOs and Warrant Officers are to be included, where possible, as active members of the Council, the number being at the discretion of the chairman.

3 The size, and extent of activities, at stations or units will determine whether or not it is necessary for sub-councils to be formed to deal with specialized safety programs E.G. with ME, Aircraft Maintenance, Supply aspects. These sub-councils are to be composed of Warrant Officers, NCOs and Aircraftmen, with the officer in charge as honorary or advisory member. An active interest is to be taken in ground accident prevention.

4 The Council is to meet monthly, and its responsibilities are to include:-

- (a) The study of the station or unit situation and the application of safety orders and safety standards to prevent all types of ground accidents and promote industrial safety.
- (b) Organization and supervising a comprehensive ground accident prevention program to include the education and instruction of personnel in safe practices in off-duty activities.
- (c) Making recommendations to the parent CHQs, subject to the CO's approval, on matters that would further the prevention of ground accidents and industrial hazards throughout the RCAF.
- (d) Keeping a record of all meetings and activities maintaining and reporting accidents statistics.

5 A suitable number of personnel from each section, hangar, work shop, etc., are to be given a course in First Aid under the supervision of the SMO.

6 Safety Councils are to be formed at Command or Group Headquarters under the chairmanship of the STSO. Members are to be personnel occupying positions similar to those at stations as stated in para 2, and instructions in paras 3 to 5 are to apply as applicable. The prime responsibilities of such Councils, however, are to provide assistance and guidance to their station or unit Councils, and to forward to higher authority recommendations regarding the prevention of ground accidents and the elimination of industrial hazards.

SAFETY PRECAUTIONS

CLEANLINESS

1       Precautions are to be taken with regard to the cleanliness of personnel handling lead, lead oxides or paints, mineral oils, dope and cellulose enamel, acids, caustics, etc. Exposure to the above may lead to dermatitis (inflammation of the skin), and hands should be washed as soon as possible after contact. This precaution should be taken before putting anything into the mouth or touching the lips. Food should not be eaten or placed near any of these materials.

CAUTION

Gasoline should never be used to clean large surfaces or large articles i.e.: floors, clothes, engines, airframe or engine parts etc. Safe commercial substitutes are available. Where gasoline is called up as a cleaning agent in AFEs, it is to be used in very small quantities and the precautions outlined in EO 45-5A-2 are to be rigidly enforced. Remember -1 gallon of gasoline is equal to 85 lbs of dynamite in destructive force.

2       Adequate washroom and toilet facilities are to be available in all hangers and workshops. For the removal of injurious substances, non-irritating soaps or detergents are to be provided, together with a supply of hot and cold water and facilities for individual drying.

3       To prevent the spread of infection, do not spit either on the floor or in cutting lubricant. Gloves and protective creams (Ref. 33C/399 and 592) are to be used to protect hands and forearms against irritation from dopes, thinners, solvents, acids, alkalies, oil, cleaners, paint ingredients and other chemicals. When indicated, aprons, coveralls, boots and sleevelets of suitable material are to be provided and maintained in a sanitary condition.

SAFETY PRECAUTIONS

FIRE HAZARDS - GENERAL

1 DURING REFUELLING OPERATIONS OR REPLENISHMENT OF THE OIL SUPPLY IN AIRCRAFT, MARINE CRAFT, AND MOTOR TRANSPORT VEHICLES, AND GASOLINE OPERATED AIRCRAFT SUPPORT EQUIPMENT NO MECHANICAL WORK OR REPAIR OF ANY NATURE IS TO BE UNDERTAKEN.

Note

Refuelling of aircraft is to be done at a safe distance from the hangars or other buildings in the vicinity. Under no circumstances is refuelling to be carried out inside the hanger. Refer to EO 00-25-6.

2 Greasy overalls or rags are not to be rolled tightly and left in lockers, corners or on shelves. Overalls are to be hung on the racks provided and discarded rags should be placed in a covered metal container.

3 The wearing of steel cleated footwear when working in or near aircraft or hangars is strictly forbidden. In addition to the superficial damage which may be caused to aircraft outer surfaces there is a strong danger of sparks igniting the highly inflammable liquids and materials which are always in or near aircraft and hangars. Therefore, personnel working on aircraft are to use either wing mats or must wear the approved protective footwear at all times. This footwear is the regular issue airman's boot Ref 22M/11, resoled with composition material impregnated with cork in accordance with AFRO 98/57. Maintenance officers and NCOs are to ensure that personnel wearing cleated footwear are not permitted to work in areas where a danger of fire from sparks may exist.

NOTE

The protective footwear mentioned above is also to be worn by personnel employed in aircraft fuel compounds.

4 Ordinary ventilation in hangars does not eliminate vapors caused by fuel spillage. Consequently, extreme care is to be taken before using an open flame, hot element equipment, steam jennys, blow torches, heaters and gasoline operated aircraft support equipment. Ensure that all vapors are expelled by opening doors and windows where practical.

5 Extreme care is to be exercised by personnel to ensure that electrical equipment (e.g. drills and screwdrivers) incorporating exposed commutators is not used in the presence of flammable vapors or materials. To eliminate the risk of fire under these circumstances, pneumatic equipment is to be used wherever possible.

6 The application of heat processes requires great care. Allowance should be made for expansion and contraction. Tubular work should be made for expansion and contraction. Tubular work should be examined for venting to permit the escape of air or steam when heat is applied.

7 Fire-brick, metal screens, or sheet asbestos may be used to screen objects from an open flame. Stone, ordinary bricks or concrete should not be subjected to heat as there is danger of these materials splitting with considerable force.

8 Gasoline blow torches are to be used in Maintenance Workshops only and, if possible, in one part of that shop. A special trough lined with fire-brick or sheet metal and placed on a table is to be provided for the lighting of blowtorches. No attempt is to be made to light a blowtorch until it has been thoroughly heated by gasoline in the priming cup.

9 Only qualified personnel are to be permitted to light or operate blowtorches, lamps or fire pots on gasoline operated aircraft support equipment. Care must be taken in directing the flame, which in bright light is almost invisible.

10 Personnel are to familiarize themselves with Station Standing Orders governing fire fighting, basic instructions on the use of fire fighting equipment on Unit strength, and the procedure to be followed in case of fire. The co-operation of the Unit Fire Prevention Officer should be requested in this regard.

## SAFETY PRECAUTIONS

FUMES NOXIOUS OR EXPLOSIVE

1 Exhaust fumes from internal combustion engines are not to be discharged into an enclosed building. These fumes are injurious to health and if inhaled in an enclosed space, may have fatal results. MT vehicles are not to be allowed to remain in the workshops or at entrances to buildings with the engine running during loading or unloading operations.

2 Fumes given off by ethylene-glycol are irritating to the eyes and produce toxic effects if inhaled for any length of time. The effects of inhalation are cumulative, but they can be thrown off in about 36 hrs. These fumes may be inhaled during maintenance operations of aircraft or MT vehicles.

3 If work is done where these fumes are present, the Officer or NCO in charge of the work is to arrange whenever practicable, a rotation of personnel on the work so that no personnel are exposed for long periods, 36 hours are to elapse before personnel are again similarly employed. The fluid is not to be handled in rooms where fumes may collect and remain. The fluid is to be stored only in closed containers.

4 Smoking in rooms where equipment employing tri-chlorethylene is used is to be strictly prohibited. The inhalation of tri-chlorethylene fumes through the glowing end of a cigarette forms phosgene, a very toxic poison, which has immediate effect.

5 The attention of all personnel is to be drawn to the fact that carbon tetrachloride is very toxic, and may cause damage to the kidneys, liver, heart and lungs and in severe cases of exposure - death. It is, therefore, to be used sparingly, should be used outside wherever possible, and only used inside when suction ventilated booths or tanks are available with a linear air velocity of 100 feet per minute. Under no circumstances are soaking baths of carbon tetrachloride to be used. The use of carbon tetrachloride in spray guns is strictly forbidden. Containers of carbon tetrachloride are to be kept sealed when not in use. Protective clothing is to be worn when working with this chemical. Tri-chlorethylene or some other less hazardous material is to be substituted for carbon tetrachloride whenever possible.

6 Isopropyl Alcohol Spec. 3-CP-525 (Ref. 33C/605) is used as de-icing fluid in the RCAF. While it is not as dangerous as other types of alcohol, nevertheless, all de-icing alcohol is to be handled carefully because:

- (a) It is poisonous.
- (b) It is inflammable.
- (c) The fumes given off are dangerous.



E000-80-4/4

7 Cadmium poisoning will result from the swallowing or inhalation of cadmium salts, fumes or dust. The symptoms of poisoning by swallowing are a sudden onset of nausea, vomiting and kiarrhoea which follow almost immediately after contaminated food or beverage has been consumed. Cadmium plated utensils must never be used in the storage or handling of food or beverage. The inhalation of even minute quantities of cadmium fumes or dust causes dryness of the throat, cough and headache, vomiting, and a sense of constriction in the chest. More severe exposures produce marked lung changes with a persistent cough, pain in the chest, severe shortness of breath and prostration, and may have fatal results. To protect personnel exposed to cadmium fumes or dust, forced ventilation and positive air supply respirators must be used. All cadmium plate must be removed from metal prior to welding or burning. Care is to be exercised, when using solder containing cadmium, that it is not overheated.

CAUTION

Medical assistance must be obtained immediately when symptoms of cadmium poisoning are evident.

SAFETY PRECAUTIONS

PRESSURE RISKS

INTRODUCTION

1 The purpose of this order is to point out the occupational hazards encountered by personnel who find it necessary to work with, and around high pressure air equipment, while engaged in servicing and maintenance work on aircraft. It is felt that a clearer understanding of the risks involved is necessary, in order to eliminate many of the accidents causing injury to personnel and damage to equipment. The RCAF has recently experienced two of these unfortunate accidents. The demand for high pressure air in modern aircraft is ever increasing, therefore, a more strenuous programme of safety will have to be initiated by all units if compressed air accidents are to be held at a minimum.

2 When operating hydraulic presses and testing equipment, hand operated arbor presses and air compressors, special attention is required to prevent building up of any excessive pressures and avoid mechanical failures which would cause damage or injury. Pressure released valves of hydraulic or pneumatic appliances are to be tested frequently to ensure they are functioning correctly. When using presses where collapse of work or support is possible, suitable guards are to be placed in position to prevent any damage by parts that may otherwise be thrown across the workshop.

3 Air compressors are to be drained of water frequently, otherwise the combination of oil-mist and water-vapor that is formed during the operation of the compressor unit may be ignited by the heat which is generated, thereby resulting in an explosion. Explosion risk is reduced by using a lubricating oil of a high flash point in the compressor or crankcase. Fixed pipe lines are to be arranged so that there is a gradual rise from the air container to the extreme tapping points.

4 Compressed air is to be used only for the job for which it is intended. Clothes and hair must not be cleaned with air under pressure. Compressed air is not to be used carelessly or in play, and should never be blown against anyone, as it might enter the body with injurious or even fatal results.

5 Listed below are a few common precautions that should be observed by everyone handling high pressure air compressors:-

- (a) It is of the utmost importance to ensure that all HIGH PRESSURE compressors have a SCREW-ON type of air chuck installed, and also that the servicing hose is HIGH PRESSURE type conforming to MIL-H-5511 Specification or equivalent. Under no circumstances is a low pressure type of air charging chuck to be installed and used on a high pressure air compressor, i.e. above 2000 psi.

- (b) When attaching a chuck to the air charging valve, after the connection has been made, it is advisable to hold the compressor hose at the connection with the hand until the pressure has started to flow through. This will prevent the severe backlash experienced should the connection be improperly fitted. Make sure that the servicing valve is closed before attempting to make a chuck and air charging connection.
- (c) Before attempting any repair work or changing of air dryer cartridges, make sure that the compressor system has been completely drained of air. This is particularly true of repair work on oleo struts or air and hydraulic accumulators.
- (d) When rapidly discharging the compressor through the discharge line, install a balanced tee at the discharge end of the hose to prevent serious recoil action. Use a relief or hand valve to relieve pressure.
- (e) Always KNOW your working pressure. Use the gauges provided or use inflator gauges.
- (f) Avoid fast charging of all apparatus.
- (g) Never attempt to tighten or loosen fittings that are under pressure.
- (h) Never experiment by changing the lines, valves, etc., to obtain a higher pressure than specified in the handbook or EO.
- (j) Personnel are to ensure that they are familiar with the compressor they are using. BEFORE ATTEMPTING TO OPERATE A COMPRESSOR THE APPLICABLE ENGINEERING ORDER OR HANDBOOK SHOULD BE READ and servicing instructions carried out.
- (k) Never operate gasoline engine powered compressors in a closed room unless the exhaust gases are piped outside.
- (l) Do not attempt to re-fuel gasoline engine model compressors while the engine is hot.

6 Units having aircraft equipped with armament systems radar and telecommunications equipment requiring pressurization are advised of the serious threat of explosion resulting from pumping volatile liquids or gases into the assembly during pressurization.

7 Units are to ensure that no radio or radar installation is pressurized when explosive fumes are in the vicinity.

8 Approved pumps only are to be used for pressurizing electronic assemblies and are to be kept clear of inflammable liquids or gases at all times, including whilst in storage.

SAFETY PRECAUTIONS

REFUELLING OF AIRCRAFT

General

- 1 The refuelling and draining of aircraft is a hazardous operation, with the ever present danger of fire and explosion resulting from accidental ignition of the highly inflammable vapour being released.
- 2 The constant danger makes it imperative that all personnel engaged in the handling of fuel be constantly alert and that every precaution is taken to minimize fire and explosive hazards.
- 3 During refuelling operations all other work on the aircraft is to cease and personnel are to leave confined spaces in or on the aircraft.
- 4 Adequate and suitable fire fighting equipment is to be readily available and all personnel concerned thoroughly trained in its use.
- 5 To safeguard against the danger of explosion which exists when an aircraft with partially filled fuel tanks is placed in a hangar, tanks are to be filled to 90% of their capacity prior to hangar allotment. This will permit fuel expansion within the tank caused by temperature increases yet eliminate any possibility of fuel venting. The above requirement does not apply, however, to the following aircraft:
  - (a) Placed in storage with the drained fuel tanks.
  - (b) Being weighed.
  - (c) Undergoing repair and/or maintenance to fuel systems necessitating defuelling.
  - (d) Requiring partially filled or empty tanks due to operational or test purposes.

Location of Aircraft

6 Aircraft having tanks to be refuelled, defuelled or drained are to be located on field aprons or dispersal sites at least one hundred feet from buildings, open flares, flames, torches, welding, sandblasting, spray painting or other sources of possible ignition. Aircraft are to be positioned adjacent to tarmac earthing buttons and static "aircraft to ground" connections are to be maintained at all times. Whenever possible, during fuel transfer operations, a distance of at least 50 feet from other aircraft is to be maintained.

Location of Tender

7 On transfer of fuel to or from an aircraft, the truck is to be located as far from the aircraft as possible, consistent with satisfactory refuelling operations, and in such a position that it can be driven quickly from the area without reversing. The tender operator, prior to commencing any transfer of fuel, is immediately to complete the ground connection

from tender to apron earthing button, and will ensure that the aircraft ground wire is also secured to the same button. The aircraft refuelling party member, handling the nozzle, is to ensure that the nozzle ground wire is connected to the aircraft ground connection, adjacent to the tank filler, prior to removing the tank filler cap(s). The tender is to be moved from the refuelling or defuelling position near the aircraft as soon as fuel transfer is completed.

NOTE

Where fuel servicing operations are conducted on ice, sandy or desert terrain, or wherever it may not be practicable to secure a satisfactory ground, the aircraft and fuel dispenser shall be connected by a bonding cable, and a further bonding cable connected between the fuel nozzle and the aircraft tank filler ground lug prior to opening the cap (NOTE: Where aircraft are fitted with "plug and jack" bonding facilities adjacent to the aircraft filler cap, these are to be used). Under these conditions, reliance is placed on equalizing rather than draining static charges that may accumulate on the aircraft, fuel dispenser, fuel hose and nozzle. It is important that objects possessing different electrostatic potentials are not brought into contact with this equipment in a manner which may produce a spark gap in the proximity of a flammable vapour-air atmosphere.

- 8 The tender operator will remain with the tender during refuelling or draining operations.
- 9 Refuelling tenders, whether loaded or empty, are not to enter or be stored in hangars.

Static Electricity

10 Before refuelling or defuelling operations commence, the sequence of earthing the tender and aircraft will be:-

- (a) Connect aircraft to tarmac grounding button.
- (b) Connect tender tank or drum to the same ground button as the aircraft.
- (c) Connect the hose nozzle ground wire to the aircraft tank filler ground lug before removing tank filler cap.

11 Where funnels are utilized to facilitate refuelling or draining the funnel is to be grounded to the aircraft. Metal retaining devices securing fur felts in a funnel are to be bonded to the funnel.

Precautions

12 The refuelling party will ensure that all radio equipment, receivers, and transmitters in the aircraft are turned off; that batteries are not being serviced or replaced; that battery carts or generators are not in use; and that no electrical apparatus such as electrical cords, droplights, floodlights, etc., supplied by outside power, is in or near the aircraft.

NOTE

External power may be used during pressure refuelling, however, the following precautions must be strictly adhered to:

Personnel are to ensure that the energizer power switch is in the OFF position prior to engagement with or disengagement from the aircraft.

The energizer is to be located on the opposite side of the aircraft to that occupied by the pressure refueller, and is to be placed at the maximum distance from the aircraft consistent with normal safe operation.

13 A member of the refuelling party will stand by with the fire extinguishing equipment.

14 Before removing aircraft tank filler cap the provisions of paragraphs 7, 10, 11 above are to be strictly observed.

15 Only one fuel tank filler cap is to be removed at a time. The cap is to be replaced immediately after filling the tank and before removing cap of any other tank. Exceptions to this rule may be made if fuel refuelling equipment and trained personnel are available, or if pressure refuelling is being carried out.

16 When topping off a tank, the fuel flow is to be reduced by reducing the pressure at the tender prior to throttling the nozzle valve.

17 To avoid spilling fuel, the nozzle must be drained before withdrawal from the tank opening.

18 The operation of refuelling cabin tanks, where the refuelling must be accomplished inside the aircraft, introduces hazards of an extreme nature. During this entire operation, the cabin must be provided with all possible ventilation.

19 An odour of fuel within a confined space of an aircraft is an indication that an explosive mixture may be present and every precaution must be observed until such time as vapours are dissipated and the condition corrected.

20 Special precautions applicable to a specific type of aircraft are to be observed.

21 Where refuelling from drums is carried out, personnel are to observe the foregoing instructions.

22 Mobile equipment, other than that engaged in refuelling, is not to approach the aircraft while refuelling operations are in progress, EXCEPT as specifically authorized in AFEO 30-1-10, Part 4, Sect. 4, para. 22(o) for ADC Units operating CF-100 aircraft.

SAFETY PRECAUTIONS

AIRCRAFT FUEL DE-ICER OIL TANKS CLEANING AND REPAIRS

1 Personnel engaged in the cleaning or repairing of aircraft fuel, de-icer or oil tanks are to take the precautions detailed in this order to avoid the possibility of accidental injury as a result of:

- (a) Explosion or fire.
- (b) An excess of gasoline vapor or a deficiency of oxygen for respiration.
- (c) The presence of toxic liquids, gases or dusts.
- (d) Other hazards.

2 Personnel employed in this work must wear rubber soled shoes at all times.

3 Great care must be exercised to keep electric motors, automobiles, trucks or other internal combustion engines at a safe distance from tanks which have been opened. The vapors from an open tank may travel a considerable distance and be ignited by such equipment and flash back to the tank.

4 All electric extension cords and extension lights must be enclosed with vapor proof covers. Sparks from defective cords and non-vapor proof lights are the most frequent causes of ignition.

WARNING

Only Vapor Proof Lamps (Red. 5A /1207 or 1208) are to be used when working in or above aircraft fuel tanks. Lamps used are to be thoroughly examined to ensure that all electrical connections are sound and that the extension cord itself is fully serviceable before plugging it into any electrical outlet.

5 Personnel entering fuel tanks are to wear a life line and a positive-pressure type air line respirator. The air supplied to the respirator is to be drawn from a source outside building or from a room free from dust, gas and fumes. In cases of emergency, where a positive pressure type respirator is not available, a service anti-gas respirator suitably modified may be used. This modification is to be carried out by the removal of the respirator valve at the top of the cannister and the fitting of a corrugated rubber hose, of a suitable diameter and length, by means of a metal sleeve and a hose clamp.

6 An observer is to be posted so that he can give constant attention to personnel who may show signs of distress while working inside the tank. The observer is to remain up-wind of the tank entrance.



7 Personnel are to have a cleansing bath or a shower immediately after coming out of an aircraft fuel tank to remove any tetraethyl lead that may be in contact with the skin.

8 Two fire extinguishers, one of which is to be a carbon dioxide type and the other a dry-chemical type, are at all times to be standing by as close as possible to the entrance of the tank and the observer (mentioned in para 6). At least one and preferably two men in the crew are to be proficient in rendering artificial respiration and First Aid. In the event of an accident, resulting in injury to personnel, obtain the services of a Medical Officer immediately.

9 A naked flame is not to be permitted to be brought within 24 feet of a tank which has contained gasoline, kerosene, fuel oil, alcohol or lubricating oil until the safety precautions as described herein have been carried out.

10 The following general precautions are to be taken before any attempt is made to render the tank free from explosive vapor:

- (a) A history card is to be attached to each tank and the NCO in charge is to initial the tag after each of the following steps have been completed.
- (b) A ground wire is to be securely attached between the tank and a suitable ground post or metal framework of the building, ensuring that a good metal to metal contact is made at each end of the ground wire and that there is no possibility of the connection being broken by movement of the aircraft or the tank.
- (c) The tank is to be completely drained by opening the drain fitting in the sump. All inspection covers are to be removed and the remaining fuel or oil drained through the openings. Residue which remains in the tank is to be removed by a suitable suction pump.

#### CAUTION

Do not use a rag to mop up residual fluid because there is a danger that particles of the material will become detached and remain in the tank.

- (d) A non-integral tank is to be inverted, grounded, and placed on trestles in an isolated section of the workshop to allow free circulation of air around the tank. The section of the shop selected must not be in the vicinity of any electrical equipment (motors, compressors, drills, grinders, etc.), internal combustion engines, or any other equipment which could ignite vapor escaping from the tank.
- (e) The tank is to be flushed with hot water admitted at the lowest possible point and allowed to overflow at the top, thus removing deposits of combustible material adhering to the inside surfaces of the tank.

11 The tank is to be purged of all explosive vapor, after the general precautions entailed in para. 9 have been carried out, by one of the following methods:

WARNING

Certain slushing compounds used to coat the interior of tanks may contain combustible materials; therefore, all tanks whether new or used are to be flushed prior to repair or modification involving welding procedures.

- (a) After flushing with water, the tank for a minimum period of three hours for fuel tanks, or a minimum period of one hour for oil or alcohol tanks. The tank is to be mounted so that an opening is available at the top and one at the bottom at the lowest point of the tank. The live steam is to be fed in at the top opening and allowed to escape through the bottom opening; all other openings are to be closed. Steam vapor cleaners, such as the Kerrick or Hy-Pressure Jenny cleaners, should not be used for cleaning in lieu of live steam, as the temperature of the vapor from such cleaners is not high enough to positively remove the danger of explosion. They may, however, be used as a substitute for the hot water flushing specified in para. 10 (e).

WARNING

Repair operations are to be commenced immediately the steam cleaning is completed. If repair is not completed within four hours of the cessation of steaming, tank must be recleaned with live steam.

- (b) If facilities for cleaning with live steam are not available, the tanks are to be cleaned, as specified in para. 10(e) and then dry ice (CO<sub>2</sub>) is to be placed in the tank in the proportion of one pound to each twenty-five gallons of tank capacity. To obtain quick evaporation, one half of the dry ice should be crushed into small pieces ( $\frac{1}{4}$  to  $\frac{1}{8}$  inch in size). The remainder of the dry ice should be in pieces one to two inches in size, to maintain a constant slower rate of evaporation. After the dry ice has been in the tank for approximately fifteen minutes, or when the gas can be observed flowing out of the top of the tank (similar to visible heat waves rising from a smokeless fire or a heated surface), it is safe to begin the tank repair. If the repair is extensive, operations cannot be continued longer than one-half hour when dry ice must be added, in one to two inch pieces, in the proportion of  $\frac{1}{2}$  pound to each three gallons of tank capacity for each half hour the work is to be continued. This method operates on the principle of reducing the oxygen content of the tank to a point where combustion is impossible.

NOTE

It is important that all openings at the bottom of the tank are tightly closed, as CO<sub>2</sub> gas is heavier than air and will escape if the lower openings are not tightly closed.

Due to the refrigerating effect of the dry ice, with resultant chilling of the metal which might cause cracking ahead of the weld, welding is to be carried out as far from the unmelted supply of dry ice in the tank as possible. For example, if the bottom of a tank is to be repaired, it is to be inverted, so that the bottom will become the upper surface of the tank).

#### CAUTION

A minimum of twenty-four hours is to elapse from the time the inspection covers are removed from the tank and the commencement of welding operations if either of the following cleaning methods is used.

- (c) If steam cleaning facilities or dry ice are not available, the flushing with hot water, specified in para. 10(e), will be continued for a minimum period of one hour, following which the interior of the tank will be thoroughly dried with compressed air as per para. 11(e) below.
- (d) As another alternative, the tank may be filled with cold water, taking care to avoid air pockets. Then drain and finally dry the interior of the tank, as detailed in para. 11 (e) below.
- (e) Render the tank free from explosive vapor by means of hot air blown through the tank in sufficient quantity to evaporate any residual fluid. The heated air supply from the hot air blower is to be lead to the lowest point in the tank by means of a flexible pipe, correctly bonded and grounded through the tank. The temperature of the air is not to exceed 100° C (212° F). During the blowing operation the tank is to be inverted several times in order to distribute the residual fuel over the inner surface. The air pipe nozzle is to be directed in such a manner as to cause the air to circulate, as far as possible, around the whole of the inner surface. Should the arrangement of baffles prevent the free flow of air, the position of the nozzle is to be changed in order that all parts of the tank are reached and all vent lines are blown out. The dispersal of the explosive mixture can be determined by the absence of the characteristic odor of the fuel.
- (f) Neither methods detailed in para. 11 (c) and 11 (d) above can be regarded as positive a method of removing combustible materials and fumes as the methods described in para. 11 (a) and 11 (b). Therefore, the methods, detailed in para. 11 (c) and 11 (d) above, should not be used unless absolutely necessary.

12 The cleaning of the exterior of the tank with paint remover, or other combustible solvents, is to be carried out prior to the flushing, steaming or insertion of dry ice to the interior of the tank.

13 The repair is to be accomplished as soon as possible after the tank has been cleaned and dried, all vents are to remain open and all inspection covers are to remain removed, except when dry ice is used, in which case, the instructions contained in para. 11 (b) will be followed. Every precaution is to be used to avoid an accident, regardless of what safety method has been employed to purge a tank of combustible materials, prior to the application of heat to accomplish a repair.

14 When tank repairs can be accomplished by soldering with a soldering iron and without a flame being applied to the tank, it will not be necessary to steam-clean the tank provided all combustible material has been completely drained from the tank and caution is used not to over-heat soldering irons. The irons must not be hot enough to cause dust to become incandescent, as this is sufficient to ignite an explosive mixture.

15 Non-removable or integral fuel tanks frequently have riveted seams filled with sealing compound or some other form of leak-proofing construction. Such tanks will be repaired in accordance with the instructions detailed in the relevant aircraft Description and Maintenance or Repair Instruction.

16 After welding repairs are completed the tank is to be washed internally with hot water until all traces of welding flux have been removed, and then dried with a hot air blast.

17 Before the inspection covers, etc., are replaced, the tank is to be thoroughly examined internally to ensure that no tools, rags or other foreign articles remain inside. All vent lines and connections are to be examined to see that they are clear of any obstruction.

SAFETY PRECAUTIONS

GROUND OPERATION OF JET AIRCRAFT

General

- 1 Accidents, resulting in injuries to personnel and damage to aircraft or other equipment, have occurred due to carelessness, or ignorance, of the dangers which exist during ground running of jet aircraft.
- 2 Before starting, the aircraft is to be:
  - (a) Headed into the wind, as nearly as possible, this will assist in starting and help to avoid "hot starts".
  - (b) Positioned on concrete standings, avoid running on tarmac surfaces whenever possible. Ensure that aircraft is parked in such a position that the possibility of starting grass fires is eliminated.
  - (c) Checked by personnel concerned to ensure that inflammable fluids such as fuel, oil, alcohol, or hydraulic fluid, are not free in any way to enter the air intake or compressor section of the engine. Ground run-up is not to be made if all engine accessories are not properly installed, or approved blanking plates or plugs are attached instead. The removal of accessories usually are in the low pressure area of most jet engines; this presents the major potential fire hazard. However, some accessory installations are mounted on the outside of the engine periphery and if removed, fluid leakage may present a fire hazard in the cooling annulus and after burner sections. Failure to comply with these precautions may result in uncontrollable burning with subsequent aircraft or engine destruction.

Front Area Precautions

- 3 All personnel are to be warned to treat all jet aircraft with caution, whether the engine is running or not. With two aircraft parked together, it is difficult to tell which one is running. In particular, personnel are to be warned of the dangers of approaching within a radius of twenty-five feet, throughout an arc of 220°, of the intake opening of a jet aircraft during ground running. It is possible for headgear, papers, small stones, other loose articles, AND PERSONNEL, to be drawn into the air intake(s). It is to be ensured, therefore, that the ground in front of the aircraft is clear.

NOTE

Field service caps or other loose fitting headgear, are not to be worn in the vicinity of jet engines while the engines are in operation. CAP 602, scale B23 authorizes the issue of caps mechanics Ref. 22G/5125; scale B1 authorizes the issue of caps winter Ref 22N/12; and scale B3 authorizes the issue of defenders, ear Ref 21G/5127, to ground crew concerned in jet aircraft operation.

4 The greatest danger exists on aircraft with a single intake duct and it is possible for a person to be drawn bodily into the intake duct with fatal results.

5 Attention is also drawn to the fact that it is possible to approach a running jet engine from an angle at which its noise is practically inaudible. ME personnel must be particularly conscious of this danger when approaching a jet aircraft with an ME vehicle, as the noise of the vehicle will make it difficult to determine whether or not the aircraft engine is running. During ground running, the operator in the cockpit is to watch for personnel close to the front of the aircraft, and throttle the engine back immediately this occurs.

6 Fit debris safety guards to the intake ducts, when applicable. These must be removed prior to take off.

#### Rear Area Precautions

7 The danger area of the exhaust gases extends a distance of approximately two hundred feet through an arc of 60° to the rear of the engine(s). Personnel must not attempt to enter this area, as the temperature is high enough to cause burns, and velocity is great enough to cause a person to be blown off his feet. TAKE THE LONG WAY AROUND - DON'T SHORT CUT TO THE HOSPITAL.

8 Before starting an aircraft, position it so that the exhaust is not directed towards a building, aircraft or other equipment within the area mentioned in the above paragraph. The velocity and temperature of the gases makes this precaution necessary.

SAFETY PRECAUTIONS

AERO-ENGINES USING LEADED FUELS

1 When an engine has been operating on leaded fuels (gasoline containing tetra-ethyl lead), a yellowish powdery deposit may be found on the surfaces of the engine which have been in contact with the exhaust gases. This is possible with all types of engines, particularly with turbo-jet engines and on the power recovery turbine of turbo-compound engines.

2 These yellowish deposits contain lead which, if it is inhaled or swallowed in sufficient quantities may result in lead poisoning. The following precautions are to be observed by personnel who are in contact with this hazard:-

- (a) Protect open sores or cuts to prevent admission of lead to the blood stream. There is little danger of lead being absorbed through the skin in sufficient quantities to have serious effect.
- (b) Thoroughly clean all contaminated parts before carrying out any machining, welding, shot-blasting or blowing with compressed air. This is necessary to prevent the danger of the lead particles being spread in the air inhaled by the lungs of personnel working in the vicinity.
- (c) Adequate ventilation is to be provided in the area where such cleaning is being carried out.
- (d) When handling contaminated parts, avoid passing contamination to the mouth, through food, candy or tobacco, with hands that have not been thoroughly washed with soap and water.
- (e) Care must also be taken to avoid breathing fumes or dust containing lead particles and personnel should avoid touching the nasal passages with contaminated fingers.

SAFETY PRECAUTIONS

RADAR ANTENNAE

- 1 Personnel employed in the maintenance of Radar and Armament Systems equipment, or working on aircraft in which such equipment is being tested, may be subjected to radiations dangerous to the health.
- 2 The danger due to microwave radiation is proportional to its intensity. In most airborne sets, the only danger area is immediately in front of the antenna. In very powerful ground equipment, the danger area may extend for several yards. Following the simple safety precautions outlined below will ensure the safety of all personnel from this hazard.
- 3 The following precautions are to be observed by all personnel working in or around a radar equipped aircraft:
  - (a) Do not stand directly in front of a radiating antenna. Since there is no visible signal when an antenna is radiating, avoid standing directly in front of an antenna at any time.
  - (b) Do not look directly into a radiating antenna or waveguide.
- 4 The following precautions are to be taken in the vicinity of Ground Radar Equipment:
  - (a) Do not enter radome while Radar Set is operating.
  - (b) In high power radars, do not engage in removing ice from the radome while the Radar Set is operating.
  - (c) Do not look directly into the antenna or waveguide of an operating radar.
- 5 Radio and Radar Antennae, when energized, may carry high voltage capable of igniting flammable liquids and materials, or causing bodily harm. Accidental discharge of antennae may take place by close contact with metal workstands, aircraft surfaces, or other grounded objects.
- 6 Before ground testing airborne telecom equipment:
  - (a) Ensure that the antennae are clear of all obstructions.
  - (b) Warn other personnel working on the same aircraft.
- 7 Do not test airborne telecom equipment during refueling operations.



SAFETY PRECAUTIONS

PROPELLERS

1 When moving, handling or inspecting a propeller installed on an engine it must be definitely determined that the switches are in the "OFF" position prior to handling.

2 As there is always the possibility of defective wiring, loose distributor caps, faulty switches, etc., propellers are to be treated as alive. This is further emphasized on aircraft equipment with impulse magnetos.

3 An officer or airman is not to assist in starting an aero-engine by hand-swinging the propeller.

4 When starting an engine by means of an auxiliary battery, the battery cart is to be positioned behind the line of the propeller. While removing the battery cart connection from the aircraft, the airman concerned is to FACE the propeller. The control switch on the battery cart must be in the "OFF" position before the connection plug is withdrawn from the aircraft receptacle.

5 When an aero-engine is hot from recent running, it is to be regarded as on "contact" and handled accordingly. No attempt is to be made to start a very hot engine by hand, except in cases of urgent necessity.

6 Do not attempt to approach the fuselage or pass through the slip-stream at the rear of an aircraft when the engine is being operated at speeds higher than idling rpm. If it is necessary to approach a running aircraft, attract the attention of the operator in the cockpit, by moving the aileron, or some other means, and indicate your intention. Remain clear of the slipstream until the engine(s) on the approach side have been slowed. When an engine is being operated at high speed, the force of the slip stream is great enough to cause a person to be blown off their feet with possible serious injury.

CONSIDER THE PROPELLER ALIVE: AT ALL TIMES.....

SAFETY PRECAUTIONSBENCHWORK, HAND AND POWER TOOLS

- 1 Heavy coil springs are not to be compressed in a bench vice.
- 2 Do not strike hardened steel-headed hammers together or use them to strike any hardened steel, such as drills, files, etc. - Flying chips and splinters are dangerous.
- 3 Ensure that hammer or axe heads are secure on their handles and that the handles are not cracked or split.
- 4 Always use a file with a tightly fitted handle. The file tang can cause serious injury should the file jam and the handle is loose or missing.
- 5 Use the proper sized wrench for the job and see that it is fitted properly to the nut or bolt head.
- 6 Never use a cold chisel with the head burred or mushroomed. Grind off such burrs before use - if they don't injure you, how about your neighbor?
- 7 A screwdriver should never be sharpened to a chisel point, but should be filed or ground to a straight, square point.
- 8 No metal or wood-working machinery is to be operated without authority or a thorough knowledge of the method of operation. Over 50 percent of all reported injuries, caused by such machinery, result in permanent disability.
- 9 Machinery should never be set in motion without definitely ascertaining that no one is in a position to be injured.
- 10 Guards, fences, etc., are to be installed over all exposed gears, belts, pulleys, flywheels, etc., and must remain installed while the equipment is in motion.
- 11 All rotating projections, e.g. set screws, rivets, etc., are to be filed or turned down or replaced with recessed type screws.
- 12 No conversation is to be carried on by, or with, an operator of any metal or wood working machine while it is in motion. The machine must be stopped while instructions are being given to the operator. Fingers are easily removed but can never be replaced.
- 13 Clothing of machine operators must fit snugly. Do not wear loose coveralls, baggy sleeves, dangling neckties, wrist watches, finger rings, or any other article of dress likely to be caught by revolving shafts, gears or pulleys. Close fitting caps are to be worn by personnel employed in station or unit workshops to avoid the hair being ignited by torches or caught in revolving machinery.

- 14 Use a wood handled brush to remove swarf, filings, chips, shavings, etc., from the machine bed or table. Do not use a long wire-handled brush. Never use the fingers or hand for this purpose, for, blood-poisoning frequently results if the skin is broken by sharp particles.
- 15 Keep the floor around the machine clear and clean of chips, shavings, etc. Poor footing might be fatal.
- 16 Push sticks are to be used when feeding short or narrow work past saws or knives. - Remember those fingers.
- 17 Do not wear gloves when operating machine tools, lathes, milling cutters, etc., with revolving spindles and cutting.
- 18 Prevent serious hand injuries by refraining from assisting the stoppage of the machine by hand pressure on the belt or rotating mandrels and shafts.
- 19 The lathe face plates, driving plates, chucks, etc., are to be mounted or removed with the mandrel fully at rest.
- 20 Ensure that the drill is securely mounted in the chuck of a drill press and remove the chuck wrench before the power is turned on.
- 21 Do not leave a machine unattended while it is in motion.
- 22 Do not hold objects being ground or drilled, with a rag.
- 23 Machine operators must wear goggles when engaged in grinding, machine operations, handling molten metals, caustics or acids, welding, sandblasting or doing any other work where flying or splashing material may enter the eyes.
- 24 Dust respirators must be worn during sandblasting operations or grinding soft materials, e.g. bonded asbestos brake linings.
- 25 Buffing or grinding machines are to be mounted with sufficient clearance around each side to permit easy access to both wheels. The wheels are not to be in a direct line with the operator of any other machine, otherwise work accidentally thrown across the shop by the wheels may injure personnel.
- 26 Personnel operating grinders must not wear greasy overalls.
- 27 Keep all inflammable material clear of grinding machines.
- 28 A suitable close fitting guard is to be mounted over grinder wheels to prevent sparks flying.
- 29 The adjustable support must be securely attached and as close to the wheel as possible.
- 30 Ensure that the wheel speed is sufficient before work is started.

- 31 The minimum diameter of the wheel is to be stamped on its side.
- 32 Material should be staked securely and clear of the vicinity of machines piled in such manner as to permit a clear passage without the risk of injury.
- 33 Report to the Medical Officer after an injury, including minor injuries, even when first-aid has been applied. A neglected cut or scratch may result in blood-poisoning with drastic results.

SAFETY PRECAUTIONSHANDLING OF PETROLEUM PRODUCTS

1 All petroleum products are regarded as highly flammable and poisonous liquids and as such they should be treated with respect. Observance of the proper precautions will lessen the risks involved and will reduce the number of accidents caused by the mishandling of petroleum products.

Fire Hazard

2 Fire risk is present at all times, often at a considerable distance from the combustible product. This is due to the fact that petroleum vapours are heavier than air, and tend to flow and collect in low lying depressions and pockets, particularly in the absence of draughts or ventilation. Petroleum vapours have been ignited by static electricity, sparking from flashlights and shoe nails, operating aircraft engines or electrical equipment in aircraft, and friction from pocketed matches and lighters.

3 Refuelling tenders are to be securely grounded to POL tank filler lines before filling operations commence. The tender grounding reel wire is to be connected to the common storage tank earthing line prior to opening of the refueller manhole and movement of the filler line into position for filling. At the same time, the filler nozzle spider is to rest firmly on the fueller manhole opening. The refuelling tender operator is not to leave the filler nozzle, prop open the nozzle valve or otherwise leave the nozzle or tender unattended at any time while fuel is flowing.

Toxicity

4 The handling of petroleum products may be dangerous if adequate steps are not taken to prevent contamination and inhalation. Prolonged contact with gasolines containing lead may cause dermatitis, lead poisoning and even death. Kerosenes, jet fuels, solvents and lubricants may cause dermatitis or other skin infections. Methylalcohol if taken orally even in minute quantities will attack the optic nerve and may cause blindness.

CAUTION

All aviation and ME gasolines contain large proportions of lead. If clothing, hands or other skin areas become contaminated (from spilled fuel, sludge, etc.) the skin should be scrubbed to remove all traces of the fuel and the clothing should be cleaned, washed or discarded.

SAFETY PRECAUTIONS

HANDLING OF CHROMIC ACID

1 Adequate safety precautions must be observed in handling chromic acid and empty chromic acid containers.

WARNING

An explosion, with resultant severe injury, may occur if chromic acid crystals come in contact with an organic substance.

2 Personnel handling chromic acid, which is used in the preparation of chromium plating and anodizing baths, are to ensure that no organic materials, such as oils, fats, greases or alcohol, or any substances containing such materials, come into contact with chromic acid crystals or any tools or containers used therewith.

3 Any material to be immersed in a chromium plating or anodizing bath must be thoroughly degreased before immersion.

4 Empty chromic acid containers are not to be used to contain any other material. Immediately such a container is empty, it is to be thoroughly rinsed out with water and disposed of in the usual manner.

WARNING

Do not place empty chromic acid containers in garbage cans unless they have been thoroughly rinsed in hot water.

SAFETY PRECAUTIONSHANDLING OF FLAMMABLE MATERIALS NEAR AIRBORNE RADAR SETS

1 Tests have proven that radar beams can cause the ignition of fuels at considerable distances from operating radar sets. To minimize this danger, personnel involved in ground testing or operation of airborne radar equipment must ensure that the following precautions are observed:

- (a) No spray painting may be carried out within 100 feet of an operating radar search pattern.
- (b) During ground testing operations, the directional antenna must not be directed towards fuel, pain and ammunition storage facilities, engine test stands or engine test houses within a range of 100 feet.
- (c) No airborne radar set may be tested or operated if the search pattern is within 100 feet of any fuel handling or ammunition loading operations which may be in progress.
- (d) The plate voltage will be removed from all ground radar transmitting equipment within a radius of 300 ft. Special precautions are necessary for those units at which radar set AN/FPS-6 or the mobile version AN/MPS-14 is installed, no aircraft refuelling operations will be conducted within 2000 feet. The station telecommunications officer should be contacted to determine whether these radar sets are installed or are planned for future installation, in order that the necessary safety precautions can be observed.
- (e) For further information on handling flammable materials, near ground radar equipment, see EO 00-80-4/28.

SAFETY PRECAUTIONS

JACKING OF AIRCRAFT

Precautions

1 Improper or careless jacking of aircraft undergoing repair or being subjected to retraction tests creates a potentially dangerous situation where serious damage to aircraft or injury to personnel may result.

2 Because of the number of personnel generally involved in this operation, it is absolutely essential that an NCO or crewchief be detailed to supervise the preparation of the work, and in addition to the procedures in -2 AFEOs of the aircraft concerned, ensure that the following precautions are strictly adhered to:-

- (a) Adequate clearance must be maintained around the aircraft. Other aircraft and ground handling equipment is to be positioned a safe distance from the aircraft undergoing retraction.
- (b) NCO or crewman supervising the retraction test is to ensure that personnel and equipment in the immediate vicinity are well clear before commencing retraction. Movement of personnel in and around jacked aircraft is to be kept to a minimum.
- (c) Before jacking the aircraft, ensure that it is properly grounded.
- (d) Both mainplane and nose/tail jacks are to be used and the aircraft is to be jacked clear of the ground.
- (e) When jacking the complete aircraft, operate all jacks as nearly simultaneously as possible in order to keep the wing horizontal.
- (f) On aircraft where it is applicable and it is necessary to retract only one gear, the aircraft is to be jacked clear of the ground and the proper ground lock pins are to be installed in the gears that do not require retraction.
- (g) If the jacked aircraft is to be unattended for any length of time, ensure all aircraft maintenance platforms or other equipment are not in a position that would cause damage should one or more of the jacks fail.
- (h) Except where unavoidable, aircraft are not to be left in jacked position overnight.
- (j) Before jacking aircraft for weighing operations cross refer to EO 65D-35AA-5A/1.



CAUTION

Never raise an aircraft on only one jack, or lift one point at a time. Otherwise the lift is not in a vertical plane, a deflection may spring the plunger or damage the aircraft by slipping off the jack pad.

3 When it is necessary to do packing out of doors, the operation, are to be supervised by an Engineering Officer. If an Engineering Officer is not available, the Senior AETech or AFTech is to take charge. In addition to the foregoing instruction, the following are to be adhered to:-

- (a) That the ground surface is level and solid.
- (b) That wind conditions are moderate having regard for the size and type of aircraft.
- (c) That, where possible, the aircraft is to be faced into the wind.
- (d) That surface controls are locked.

SAFETY PRECAUTIONS

RADIATION HAZARDS - GROUND RADAR

1 Although studies have been made concerning the effects of high-frequency electromagnetic radiation on small animals, there is little direct evidence to support its ill effects on humans. Preliminary studies made on a large group of scientists and USAF radar maintenance personnel at Wright-Patterson AFB have failed to show any abnormal physical findings even though these personnel have been continuously engaged in work with microwave radiation at power levels equal to those currently in use at RCAF sites. However, at greater power densities, a biological hazard may be created. Also, there is danger of an electric arc being generated in the vicinity of volatile fluids such as gasoline, and as such, a serious condition is created.

2 The suspected hazards associated with microwave radiation can be broken down as follows:-

- (a) X-ray radiation.
- (b) RF radiation from the antenna as it affects:-
  - (i) Photo-flash bulbs.
  - (ii) Resonant metallic objects
  - (iii) Personnel.

X-Ray Radiation

3 Tests were conducted on the AN/FPS-6, AN/CPS-6B and AN/FPS-8 by the general Electric Company. Results showed that radiation from the modulator cabinet of AN/FPS-6 was about 5 MILLIROENTGENS at a distance of 1 foot. This was at a very small angle directly in line of sight with the illuminated electrode of the thyratron tube. The radiation from MR/hour at the distance of 1 foot. With the cover in place, only 15 MR/hour was observed at a 1 foot distance. No radiation from the magnetron section of the AN/FPS-8 was observed owing largely to the metallic housing enveloping the tube itself. A narrow beam of radiation was obtained from the modulator section of this unit centered at the visible portion of the thyratron tube element with about 1 MR at 1 foot distance. In the case of CPS-6B radar set 2 to 4 MR/hour at a 1-foot distance was observed in a narrow arc centered at the visible portion of the thyratron tube element. Thus, under normal operating conditions, with the doors closed and metal covers in place, no x-ray dangers exist on the above mentioned radar sets.

RF Radiation from Antenna

Photo-flash Bulbs

4 Tests were carried out on the AN/FPS-6 and AN/FPS-8 with photo flash bulbs to determine how close to the antenna one can safely

use these bulbs. It was found that if the bulbs were tossed into the centre of the radiated beam there was greater danger of them going off as compared with this probability when the bulbs were held in a stationary position. The size of the flash-bulb was also a determining factor as regards the ease in which it can be set off.

6 Thus, precaution should be exercised when handling photo-flash bulbs in the vicinity of a radiating radar set. The bulbs should either be kept out of the main radar beam or stored in a metal container when using them near the operating system.

7 Two hundred feet can be regarded as safe distance with AN/FPS-8; with AN/FPS-6, precautions should be taken up to 3000 feet.

Resonant Metallic Objects

8 A dipole with a measure gap was used to determine maximum gap that arcing would occur across at a given distance from the antenna. With the AN/MPS-14 operating at 5 megawatts, it was found that after 100 feet arcing was less than 1 mil; the AN/FPS-8 operating at one megawatt was found to initiate an arc of 1 mil at 75 feet. Because of the danger of arcing where volatile liquids such as gasoline are being used, care must be exercised in the handling of tools. Table 1 gives safe handling distances for volatile liquids.

Personnel

9 The conclusion that can be drawn from the personnel tests is that any part of the body except the EYES will heat up uncomfortably long before any damage is done. However, the eyes may be damaged permanently before any physical discomfort is experienced. As the above information demonstrates that certain radiation hazards exist, the following interim safety instructions are issued:-

WARNING

Avoid exposure to the primary beam of a microwave set at distances less than 200 feet when the antenna is not scanning.

Do not make detailed examination of any microwave radiator, reflector, waveguide opening or feed horn, during periods of transmission.

Keep eyes away from the line of sight angle projected from thyatron tube elements.

10 Table 1 lists the safe distances for volatile liquids in the vicinity of the radiated energy of various radar sets.

<u>Radar Set</u>	<u>TABLE 1</u>	<u>Volatile Liquids</u>
CPS-6B		300 feet or over
FPS-3		300 feet or over
FPS-6		1800 feet or over
FPS-8		300 feet or over
TPS-502		25 feet or over
FPS-502		100 feet or over

SAFETY PRECAUTIONS

ARTIFICIAL RESPIRATION

General

1 The Holger-Nielson method of artificial respiration is considered the most efficient of the methods presently being taught. The technique of the Holger-Nielson method is as follows:

Position of the Subject

(a) Place the subject with the face down, prone position. Place the subject's hands palms downward, with his forehead resting upon his hands or his head turned sideways with the cheek resting upon the hands, whichever suits the occasion. Make certain that the mouth and throat are not obstructed. Insert your finger down the throat to clear any foreign matter which may be present, remove false teeth and pull the tongue forward.

Position of the Operator

(b) Kneel on either the right or left knee, at the head of the subject, facing him. Place the knee at the side of the subject's head close to the forearm. Place the opposite foot near the elbow. If it is more comfortable, kneel on both knees, one on either side of the subject's head. Lean forward, with arms straight, and place the hands, palms down, on his shoulder blades, thumbs touching, fingers, spread out pointing downwards and outwards, with the heels of the hands at the level of the armpits.

Compression Phase

(c) Keeping the elbows straight, rock forward until your arms are almost perpendicular to the ground, at the same time maintaining a smooth, gentle and evenly increasing downward pressure on the subject's back. This movement should take about 2 seconds.

Expansion Phase

(d) Start rocking backwards, releasing pressure, allowing your hands to slide from the subject's shoulders along the upper arms down to just above the elbows, grasp the arms firmly, raise them and continue to rock backwards until resistance is felt; then let the arms down gently. This backward rocking motion should be completed in about 2 seconds. Allow about 1 second to return to the starting position. With this timing, the operation is completed in about 5 seconds and should be repeated approximately 12 times per minute.

Additional Related Directions

2 It is all important that artificial respiration, when needed, be started quickly. There should be a slight inclination of the body in such a way that fluid drains better from the respiratory passages.

The subject's head should be extended, not flexed forward, and the chin should not sag lest obstruction of the respiratory passages occur. The subject's clothing should be loosened.

(a) Once breathing has started and the subject seems to have a fair hold on life, stop the back pressure and use only the arm-lift procedure at the same rate. This is in order not to exhaust all the carbon dioxide from the lungs. Regulate your movements with that of the subject's breathing, that is, when he is inhaling, lift the arms, when he is exhaling lower the arms.

(b) Do not allow the subject any exertion until seen by a doctor; he is a stretcher case and a hospital case until medically cleared.

(c) Do not apply too much pressure because this may cause unnecessary bruising, especially if the subject is a woman. Pressure should vary according to the relative sizes of the operator and subject; a small operator will need to apply the full weight of his trunk to achieve good results with a large subject, whereas a large operator will need only a portion of his trunk weight to provide the necessary pressure with a small subject.

(d) For children over 4 years of age and very small women, pressure should be very light, and applied with the tips of the fingers. The complete cycle should be about 5 seconds. For children under 4 years, adequate pressure may be applied on the shoulder blades with the thumbs, followed by a slight shoulder lift at the rate of 15 cycles per minute.

3 For children under 2 years of age and infants, use the following technique:

(a) Place the child face down on the operator's right forearm with legs straddling his elbow joint.

(b) Place right hand middle (not index) finger in the child's mouth to keep the tongue down and the mouth open so there is free airway to the lungs, the rest of the right hand supports the head.

(c) Place the left hand on top of the child's neck and shoulders to hold the child in position.

(d) Move the arm up and down at a 45° angle each way from the horizontal. This makes the child's abdominal muscles push and pull on the diaphragm, forcing air in and out of the lungs.

4 The proper timing and rhythm is kept by repeating "out goes the bad air; in goes the good air", for a complete cycle of 12 times per minute, starting with the downward tilt as he says "out" and tilting upwards as he says "in".

5 Continue artificial respiration until the subject shows signs of life or is pronounced dead by a doctor. If no doctor is available, continue until the unmistakable signs of death appear. (glazed eyes, cold clammy skin, stiffening of the muscles, etc.)

Precautions

- 6 If you cannot hear the air passing to and from the lung after 4 or 5 complete cycles, check the subject's mouth again, remove any obstruction and ensure that the tongue is well forward.
- 7 Do not give liquids until the subject is conscious.
- 8 In cases of chest injury, omit the back pressure phase of the operation and raise and lower the arms about 12 times per minute. If the arms, back and chest are injured, perform the chest-raising phase only but grip the subject in the armpits instead of near the elbows. To prevent further injury to the subject's arms, extend them outwards or straight down at his sides.
- 9 Keep the subject warm and get him to medical care as soon as possible after normal breathing is restored.

How to change Operators

- 10 The substitute places his knee down beside the operator's knee which is at the head of the subject, his other foot at the subject's elbow. He regulates his timing with the operator by swinging over a few times with him and when they are both ready for the change-over the substitute co-ordinates his movements to come in on the back pressure without interrupting timing, allowing the original operator to slide out.

Additional Information

- 11 EO 00-80-20/1 illustrates the application of the Holger-Nielson method of artificial respiration.

SAFETY PRECAUTIONSAIRCRAFT WHEEL AND BRAKE FIRES

1 During maximum braking of an aircraft, sufficient heat may be generated to set the brake assembly on fire. This in turn can cause magnesium wheels to burst into flames. Magnesium, though not easily ignited, burns violently and it is therefore very important that the fire be extinguished as quickly as possible.

2 It is not always necessary for flames to be present to create a dangerous condition. During the cooling-down period, heat from the brake and wheel may "cook" the tire and tube, weakening the rubber so that it will blow out. To aid in cooling hot brakes, a stream of compressed air may be directed in and around the brake and wheel assembly.

WARNING

Do not use any cooling agent unless fire is present,  
REMEMBER, DRY CHEMICAL IS RECOMMENDED FOR BRAKE FIRES.

3 Even if fire is not present, it is advisable to clear the area around the wheels (Especially outboard of the brakes) of personnel. Only one man with a dry chemical extinguisher should be stationed near each wheel. His position should be to the rear and parallel to the line of wheel rotation. Where possible, this man should be a member of the crash crew, equipped with protective gear.

Action in Event of Brake and Wheel Fire

4 If the brake or wheel is on fire it is important that the fire be extinguished as quickly as possible. Proceed as follows:

- (a) Approach brake and wheel assembly from front or rear IN THE PLANE OF WHEEL ROTATION. DO NOT APPROACH BRAKE BROADSIDE. KEEP AREA OUTBOARD OF BRAKE CLEAR OF PERSONNEL AND EQUIPMENT FOR AT LEAST 100 FEET.
- (b) Direct DRY CHEMICAL AGENT on brake and wheel assembly.

WARNING

The tire casing could be damaged to the extent that it will blow out, resulting in injury to personnel.

NOTE

Many aircraft wheels are made of magnesium alloy and while this material is not easily ignited, it burns violently when on fire. Water accelerates burning and spattering. Burning magnesium will displace hydrogen from water or steam and it is possible that this hydrogen may accumulate in pockets in the wheel and brake housing, in sufficient

quantities to cause a violent explosion. (An incident occurred where a main gear wheel was blown off the axle and hurled a distance of over 100 feet). In view of this, all personnel are warned against the use of water on Brake or Wheel fires. Dry chemical agent is to be used for this type of fire.