PART 2

PHASE 7

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

I N D E X

SUBJECT

DESCRIPTION AND MAINTENANCE INSTRUCTIONS

HYDRAULIC SYSTEM PRECAUTIONARY MEASURES

Purpose

1 This Engineering Order establishes the requirement for testing of aircraft hydraulic systems after removal, dismantling, replacement and adjustment of the Hydraulic system or components thereof.

General

2 Investigations have proven that accidents and incident involving failures of hydraulic systems could have been prevented had maintenance practices as outlined in this Engineering Order been accomplished.

Hydraulic Fluid

3 When hydraulic fluid is being checked, precautions should be observed as follows:

(a) New clean hydraulic fluid is used for topping up.

(b) Ensure that containers used for topping up are clean.

(c) If contamination is detected in the filters the system is to be drained, flushed out and refilled with clean fluid.

(d) A close check of the filters is to be maintained until such times as it can be established that the contamination has been cleared up.

NOTE: Hydraulic fluid suspected of contamination by mixing with other fluid is to be discarded.

Ground Tests

4 Ground tests are to be performed to ensure the correct operations of the aircraft components when any of the following conditions have occurred. Removal, dismantling, replacement and adjustment of hydraulic system parts or components and/or refilling of the hydraulic system. The above procedures will be accomplished in accordance with relevant aircraft Engineering Orders.

NOTE: Undercarriage retraction tests are to be accomplished in accordance with AFEO 00-80-4/27

Pipe Lines

5 When hydraulic system components that do not effect the airworthiness or the role of the aircraft are removed, the aircraft may fly providing all hydraulic lines are properly blanked off with screw type plugs or blanking caps. These caps or plugs are to be of sufficient strength to stand the pressure of the primary system. The engine(s) are to be run to ensure there is no leakage around the blanked off lines.

(a) Hydraulic lines when manufactured locally by units are to be pressure tested prior to assembly as indicated in EO 05-1-3 Part 2.

6 Only in cases of emergency is hydraulic fluid, that has been contaminated with insoluble matter such as dirt, metal, rubber etc., to be filtered for further use in aircraft.

(b) The equipment required for filtering hydraulic fluid can be manufactured locally by units.

GOODRICH DE-ICER BOOTS REPAIR AND MAINTENANCE

Maintenance, Servicing and Repairs

General

1 Maintenance, servicing and repairs of Goodrich De-icer equipment are to be carried out in accordance with the following instructions:

Maintainance

2 Maintenance of Goodrich De-Icer boots is to be carried out as follows:

(a) Remove all oil and grease from the surface of the boots by washing with a neutral solution of soap and water. Rinse with fresh water and dry thoroughly.

CAUTION Care is to be exercised to avoid scrubbing as this will tend to remove the Prenite Graphite surfacing provided to afford electrical conductivity for the climination of static electricity.

(a) Inspect the boots periodically for tears, holes, bruises and loose patches.

(b) The plished dark brown or black surface which develops on the rubber parts is not to be removed. When necessary to apply patches, only sufficient space should be cleaned off for this purpose.

CAUTION Extreme care is to be exercised when refueling, to avoid dragging fuel lines etc., over the boots.

Ground Check

General

3 A ground check of the de-icer system is to be carried out at periods as detailed in the relevant aircraft EO's. The following procedure is to be carried out when ground checking.

(a) The piping arrangement of the de-icer installation should be provided with a test plug for connecting an outside source of air supply so that running the aircraft engines or pumps will be unnecessary for this ground check. The test plug is to be located beyond the check valves in the lines coming from the pumps and ahead of the control valve. A means of supplying the flow of air required, which is not to exceed 10 lbs per

sq. in., is to be devised and plugged into the system at the test plug. This test device is to consist of apressure regulator and an accumulator tank of sufficient capacity to fill the respective de-icer groups in the brief interval of time allowed for inflation by the distributor valve.

(b) When the air supply has been connected into the test plug, the check valves are to be checked to ensure that they are not allowing air to blow back through the pumps to the gyroscopic instruments.

(c) An airman is to be stationed in the cockpit to operate the de-icer system.

(d) If, for any reason, the relief valve in the de-icer system is blocked and the pressure should go above the 8 psi operating pressure, the air is to be shut off immediately and an inspection made to discover the fault.

(e) With the pressure gauge at from 7 $\frac{1}{2}$ to 8 psi operate the de-icer system. If a complete operating cycle takes less than thirty-five seconds or more than forty-five seconds, the distributor valve is to be checked to determine the cause. In cold weather when checking the de-icer system outside with the aircraft engines running, allowthe system to operate for about five minutes before checking the cycle.

NOTE: A slow operating cycle during a ground check may be caused by an inadequate source of electrical supply to the distributor motor.

(f) If any parts inflate or deflate slowly or if any gurgling is noted in the lines, such parts are to be disconnected and the lines, blown out under pressure. All sumps and drains are to be opened and blown out.

(g) The surface of the de-icer boots is to be checked for tears, holes, burises and loose patches, during the timing check.

Repairs

General

4 Repairs to the de-icer boots are to be made in accordance with the following instructions using the de-icer repair kit (Stores Ref 32C/87).

(a) Small cuts or breaks in the rubber ($\frac{3}{4}$" or less) are to be repaired with cold patches.

(b) Damage that affects the fabric reinforcement or cuts and breaks which run at right angles to the direction of stretch are to be removed and returned to stores for vulcanized repair.

(c) Parts damaged beyond repair by the methods described in (a) or (b) above, are to be removed and returned to stores for vulcanized repair.

CAUTION Aircraft are not to be allowed to fly with unrepaired damage to de-icer parts.

NOTE The de-icer repair kit contains three tins of cement. The conductive cement A56B tin bears the following: "The stability cannot be guaranteed in excess of sixty days after the date below _____". This cement is definitely usable up to twelve months after the date of manufacture. The inscription on the A56B tins should therefore be ignored. If there are any doubts regarding the suitability of the cement, shaking the tin to test its liquid state, or tyring out a small patch on scrap articles, is sufficient to ensure that the cement has not deteriorated.

Procedure for Cold Patch and Rubberized Fabric Repair

5 The following procedure is to be carried out when making cold patch or rubberized fabric repairs.

NOTE: Before repairing installed de-icer boots the tension is to be relieved by removing ten to twelve attachment screws in the vicinity of the repair. This will ensure a tension on the patch and prevent bulbing during flights.

(a) Clean the surface in the vicinity of the damage with soap and water and dry thoroughly.

(b) Determine the size of patch required and select a template or buffing shield of corresponding size.

(c) Place the shield over the hole so that the cut-out portion exposes the area to be patched, and retain the shield in place throughout the following operation.

(i) Rub the area to be patched with a cloth soaked in Benzol (Stores Ref. 14B/1147) to soften and remove the Prenite Graphite surface. Ensure that the cut or tear is not allowed to spread.

(ii) Roughen the surface with a wire buffer.

(iii) Smooth out with an emery buffer so that the surface has been removed to approximately .003".

(iv) Wash with Benzol and allow to dry.

(v) Brush on one coat of #1 cement and allow to dry.

(d) Remove the starched fabric backing from the patch and apply a light coat of #1 cement to the surface thus exposed and allow to dry.

NOTE: Keep the tacky surface of the patch clean after removing the fabric and cementing.

(e) Apply the patch to the prepared surface by sticking the centre or one edge lightly and working the remainder down so as not to trap air between surfaces.

(f) Roll the patch down securely with a metal roller or other suitable tool, ensuring that the edges of the patch are down firmly. Re-cement them if necessary.

(g) Allow the job to stand ten or fifteen minutes then wipe the patch and surrounding area lightly with Benzol.

(h) Apply a coat of Prenite Graphite cement to restore the conductive surface (Stores Ref 33C/261).

NOTE: In the event that the damage cannot be repaired with the standard patches, repair material is to be cut to suit from sheet rubber or rubberized fabric, whichever is required Ref. para 4(a) and (b). In such repairs the procedure is the same as for prepared patches except that the sheet patches are to be thoroughly cleaned and given TWO coats of cement.

Re-surfacing

General

6 Re-surfacing is necessary when any one or a combination of the conditions listed below is encountered.

(a) Flaking off surfacing material.

(b) Cracks developing in surfacing.

(c) Low conductivity.

Re-Surfacing Procedure

7 The following procedure is to be carried out: -

(a) Scrub the surface to be re-coated with a clean cloth soaked in Benzol. Use a vigorous scrubbing action to remove all loose particles and to smooth out any wrinkles in the old coating.

(b) Mask off the fairing strips so as to shiled the wing during spraying operations.

(c) Spray on two light coats of Prenite Graphite, allowing ample drying time between coats.

(d) Avoid contacting the surface after spraying until the coat is completely dry.

(e) If possible the aircraft should remain in a warm place for as long as practical after spraying to allow the Prenite Graphite coating to cure. This coating will cure in about twenty-four hours at room temperature.

OPERATION AND INSPECTION OF FUEL SELECTOR - VALVE CONTROL SYSTEMS

1 Fuel selector valves with the exception of type "D" valves are equipped with a spring loaded indexing device to bring the portsinto proper alignment and to prevent them from rotating out of position due to vibration. The main defects which are likely to cause failure are, excessive backlash or escessive stiffness.

2 It is essential that fuel selector valve settings be controlled by either of the following methods and not solely by the control handle pointer in the cockpit:

(a) With the engine running, the engagement can be felt through the control handle.

(b) With the engine not running, a decided click can be heard when the valve is turned.

3 Excessive wear will cause backlash in the control system and may result in the ports not being fully opened or closed when the control handle is turned to the desired position in the cockpit unless the limits laid down below are complied with:

(a) Backlash is to be limited to 15 degrees on an installation with several universal joints, gear boxes, or pulleys and cables, 30 degrees is permissible.

4 In cases of excessive stiffness in the system, disconnect the controls from the selector valve to isolate the components and check each portion of the system separately.

5 The selector valve itself should turn with the fingers. If it does not then check:

(a) Any unused ports to see if the poppet valve assembly has been removed to prevent seizure caused by thermal expansion of the trapped fuel.

(b) For any excessive wear of the shaft of the cam assembly.

(c) For severly worn indexing devices.

6 The remainder of the system is to be checked for undue stiffness by ensuring that:

(a) No interference exists between the aircraft structure and the control system.

(b) All gears and pulleys rotate freely.

(c) Cables are correctly tensioned and properly positioned on drum, fairloads, pulleys etc.

7 Type "D" selector valves have no indexing plate. In case of stiffness in this type of valve, remove the cover plate and rub the tapered cork base with powdered graphite and castor oil. All other types are to be replaced with serviceable assemblies.

NOTE: Whenever fuel selector valve controls are disconnected, or fuel selector valves are replaced, the reassembled parts are to be carefully checked by a qualified NCO who HAS NOT been employed in any manner on the adjustment or reassembly of the components of the fuel system.

8 Upon completion of any of the above inspections the NCO concerned is to endorse Form L-14 to the effect that the component affected has been inspected, operates correctly, and that all locking devices are locked in the correct manner.

INSPECTION OF AIRCRAFT EXTERNAL OPENINGS DURING THE NESTING SEASON OF BIRDS

General

1 To overcome the serious hazards which may develop through birds building nests in aircraft wings, carburetor air intakes etc., the following inspection is to be carried out during the nesting period from April to July.

Inspection

2 A thorough inspection of all external openings (carburetor air intakes, air intake ducts, exhaust cones, control surface operating arm openings, heater air intake ducts etc.), is to be carried out before flight during this period.

CAUTION Particular care is to be exercised if aircraft are inactive for any period of time.

EO 05-1-2AD

FORCED LANDING INSTRUCTIONS HOLDER

1 To avoid Forced Landing Instructions being misplaced or damaged after being stowed in RCAF aircraft, a standard type holder has been approved by AFHQ which will accommodate an RCAF envelope, G77. This envelope is large enough to hold all requirements for Forced Landing Instructions for service aircraft.

2 The following materials are required to manufacture one holder locally:

32B/5	Duck white, 10 oz. piece 11½" by 12"	- piece 1
29/	Fasteners, snap	- ea 2
28/9949	Screw (An530-8-8)	- ea 5
28/395	Washer (An960-8)	- ea 5

CONDITION OF AIRCRAFT AND ENGINES RETURNED TO CONTRACTORS FOR OVERHAUL

General

1 Repairable aircraft and engines have been stripped of components and accessories prior to shipment to repair and overhaul contractors. In some cases aircraft have been robbed of all accessory equipment except the bare minimum required for the flight to the contractor's plant. In other cases the units were unable to repair the aircraft for fly away and rail shipment to the plant was required. These practices result in overloading of the repair and overhaul programs, disruption of the planned phasing of the supply of spare parts and neddless expenditures of funds.

Procedure

2 No removal or exchange of components or accessories will be made except as follows: -

(a) Accessories or components may be exchanged on engines which are to be shipped to contractor on time expiry or when the cause of failure of the engine is not required to be determined. All exchanges are to e noted in the engine log book and unserviceable items tagged as such.

(b) Accessories or components may be exchanged on aircraft which are allotted to contractor for complete overhaul. All exchanges are to be noted in the aircraft log book and unserviceably items tagged as such. This action is not to prejudice the aircraft serviceability for fly-in.

3 Each aircraft or engine will, in all cases, be complete and checked to the current checking list upon transfer to the contractor's plant.

TOWING AND GROUND HANDLING OF RCAF AIRCRAFT

General

1 On all occasions when aircraft are being moved, whether in the hangar or in the open, and whether or not there are other aircraft or obstructions in the vicinity, the following instructions are to be observed: -

(a) Towing of aircraft is to be accomplished by the use of approved vehicles driven by qualified drivers in pssession of the appropriate certificate in accordance with CAP 23, Section 4, ART. 2.43.

(b) The Senior NCO or Junior NCO detailed to move aircraft shall station the airman as follows: -

(i) One man at each wing tip whose duty is to raise an adequate warning by shouting or otherwise if any obstruction is approaching close to the aircraft or vice versa.

(ii) One man in the cockpit of the aircraft to apply brakes when necessary or instructed by the NCO i/c to do so. He will ensure that the undercarriage selecter lever is in the DOWN position hydraulic pressure is adequate for braking purposes. The locking device on the tail wheel or nose wheel is released.

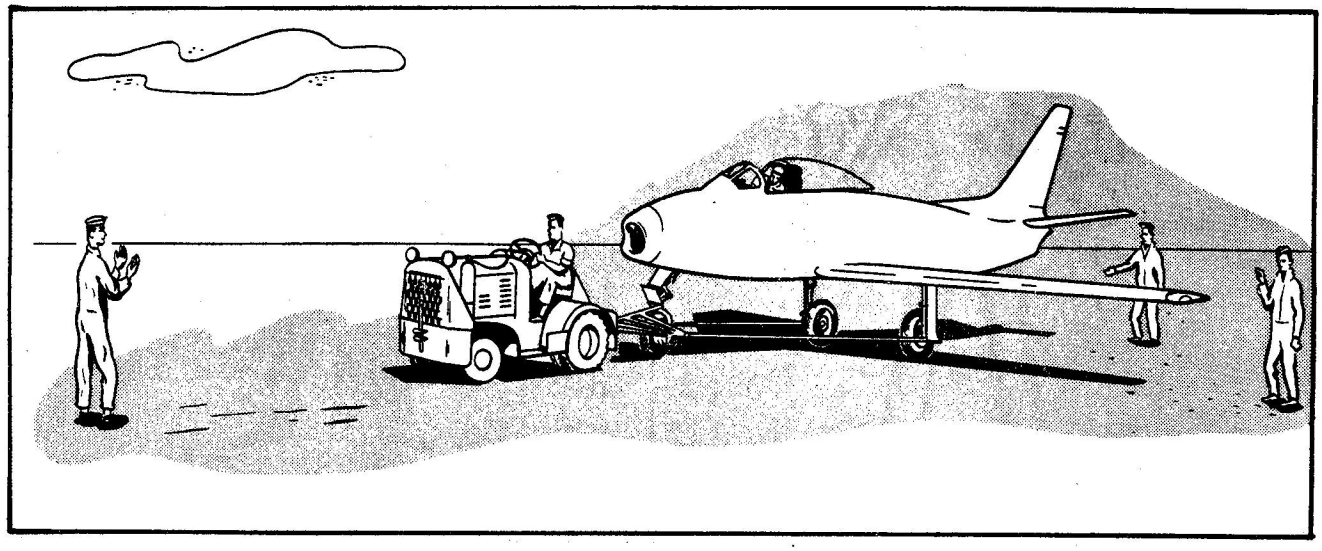
(iii) One qualified driver on the towing vehicle to operate the vehicle to successfully transport the aircraft from point "A" to "B". He is to take his instructions from the NCO in charge.

(iv) One man at the tail section to prevent any possibilities of damage to the aircraft when moving backwards and to assist in the steering where necessary.

NOTE: Where unit strength is such that the above mentioned cannot be carried out, the position of men will be left to the discretion of the NCO i/c who will ensure maximum coverage against possible damage.

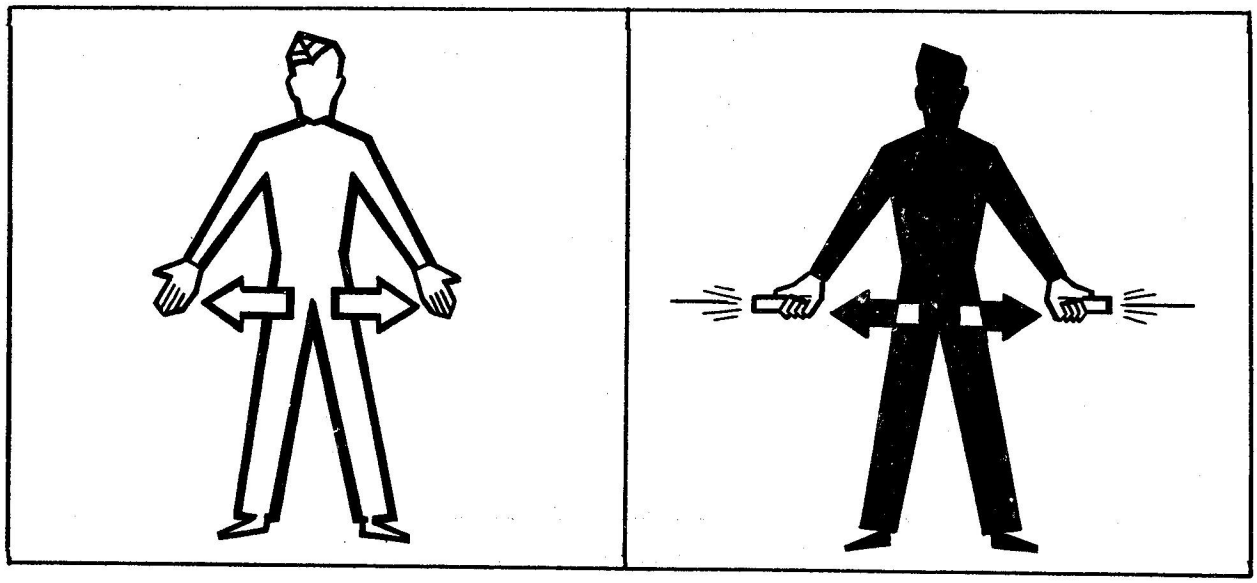
2 The NCO in charge will walk in a position where he can see either the wing tip and the personnel detailed. He will direct the driver of the vehicle, by the means of RCAF (NATO) Marshalling Signals. He is to ensure that the following is carried out: -

(a) Aircraft whall be twoed at a walking pace (approximately four miles an hour) or slower if necessary. The vehicle must be started smoothly and must proceed steadily.



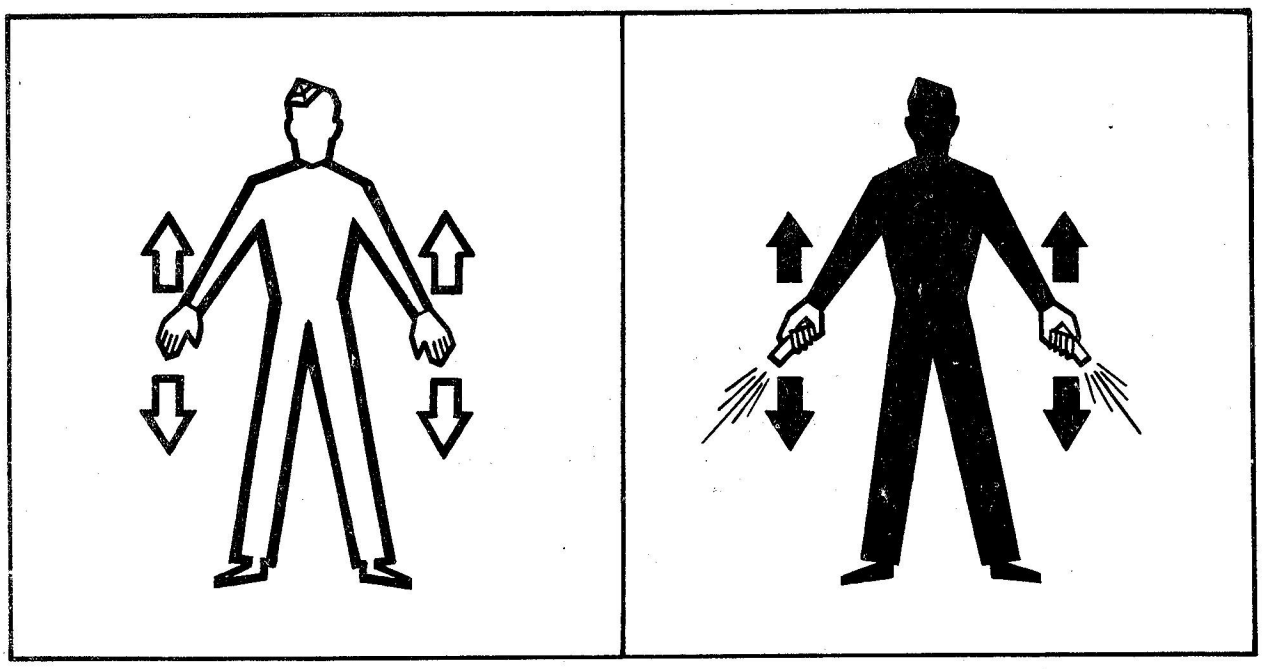
To direct the towing of an aircraft the NCO i/c is to assume the position as herein indicated keeping the eyes of the driver visible, at all times, for direction signals.

Figure 1 Towing Aircraft



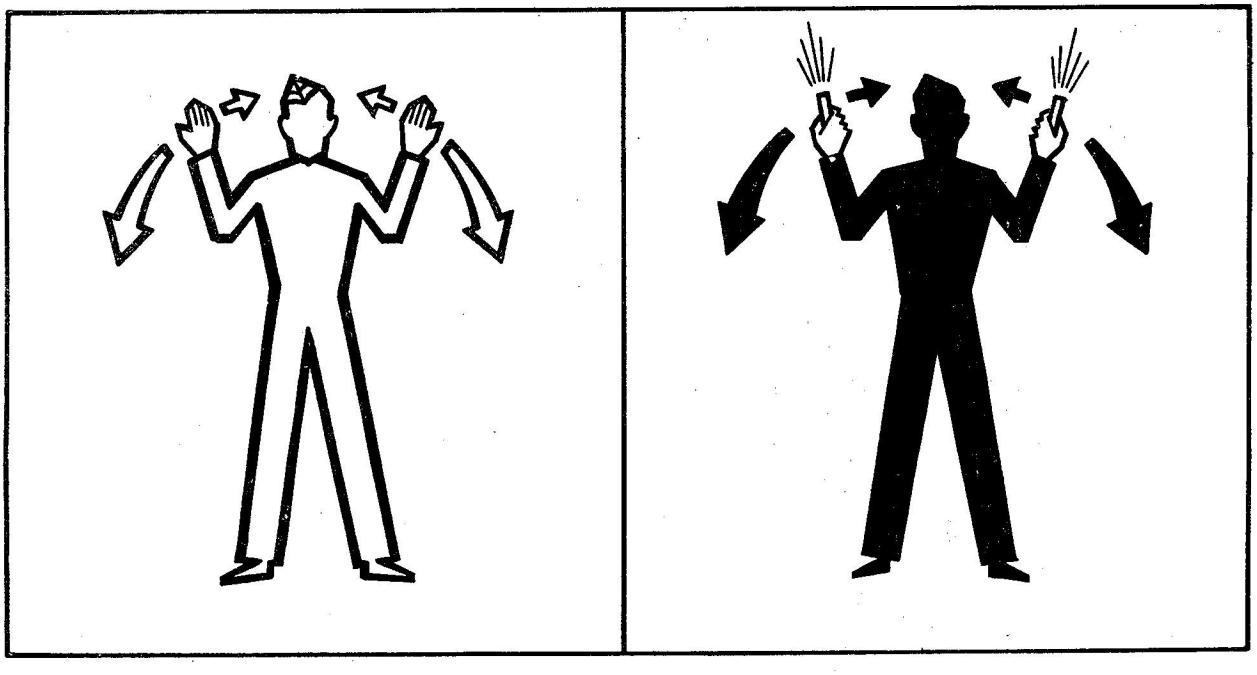
Arms down, palms facing outwards, swing arm outwards.

Figure 2 Chocks Away



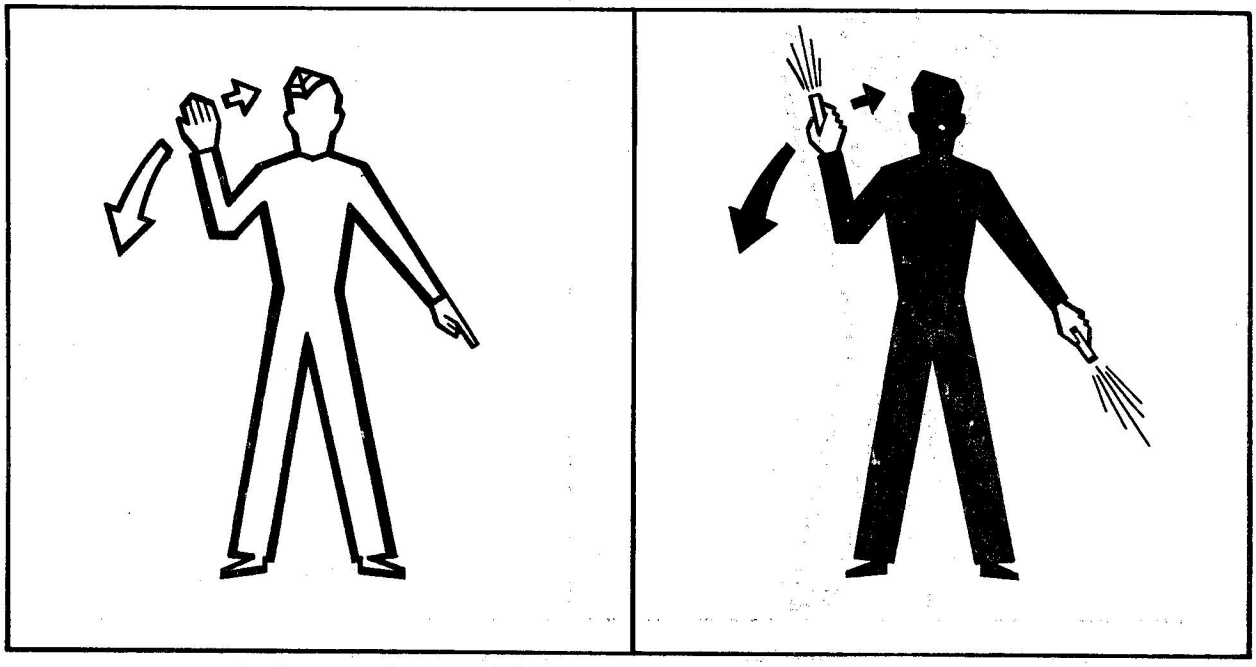
Arms down with palms towards ground, then moved up and down several times.

Figure 3 Slow Down



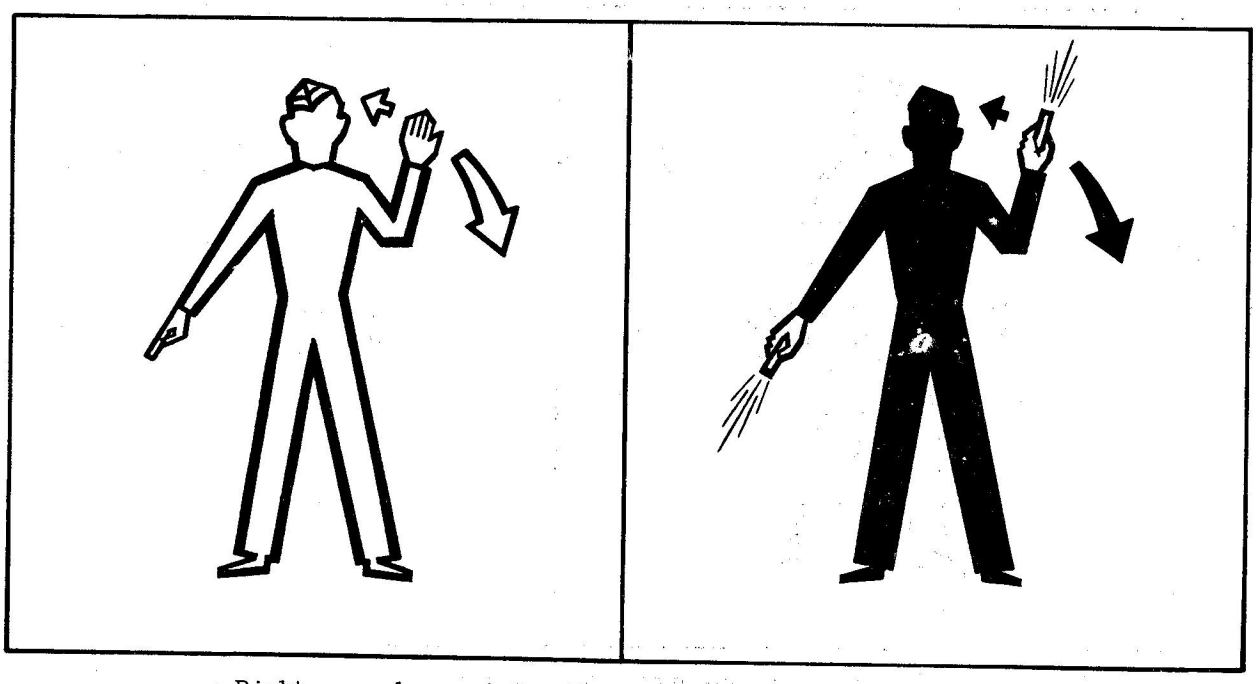
Arms repeatedly moved upward - backward, beckoning onward.

Figure 4 Straight Ahead



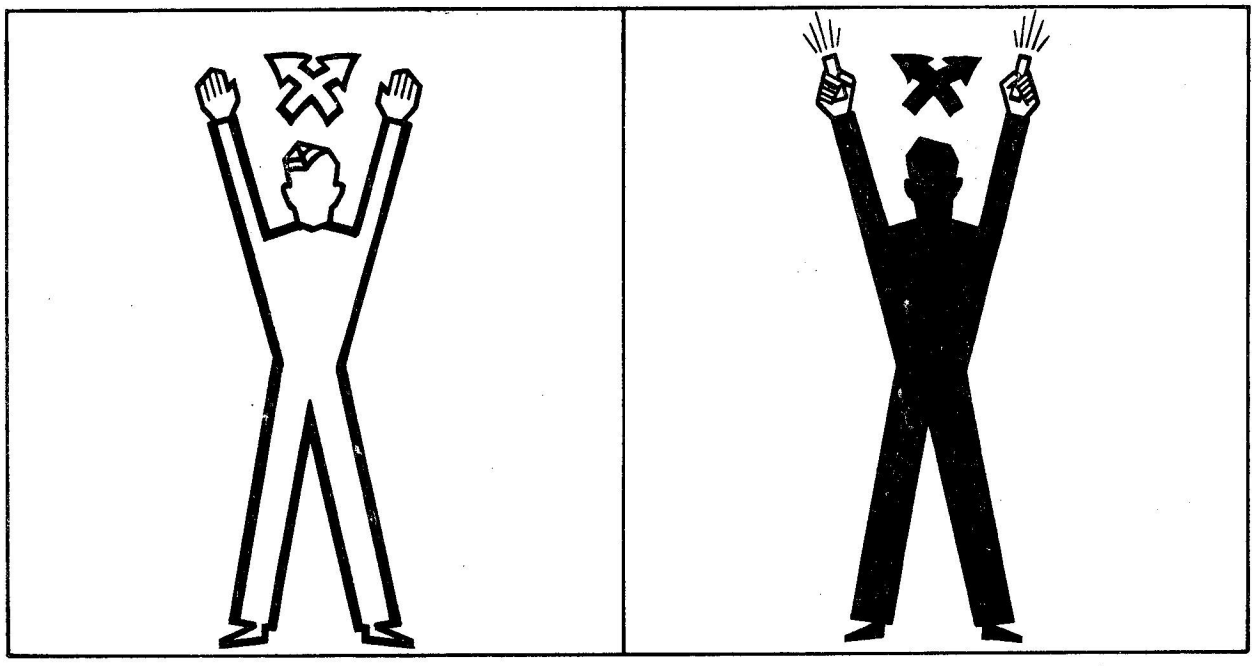
Left arm down, right arm repeatedly moved upward - backward. Speed of arm movement indicating rate of turn.

Figure 5 Turn to Starboard



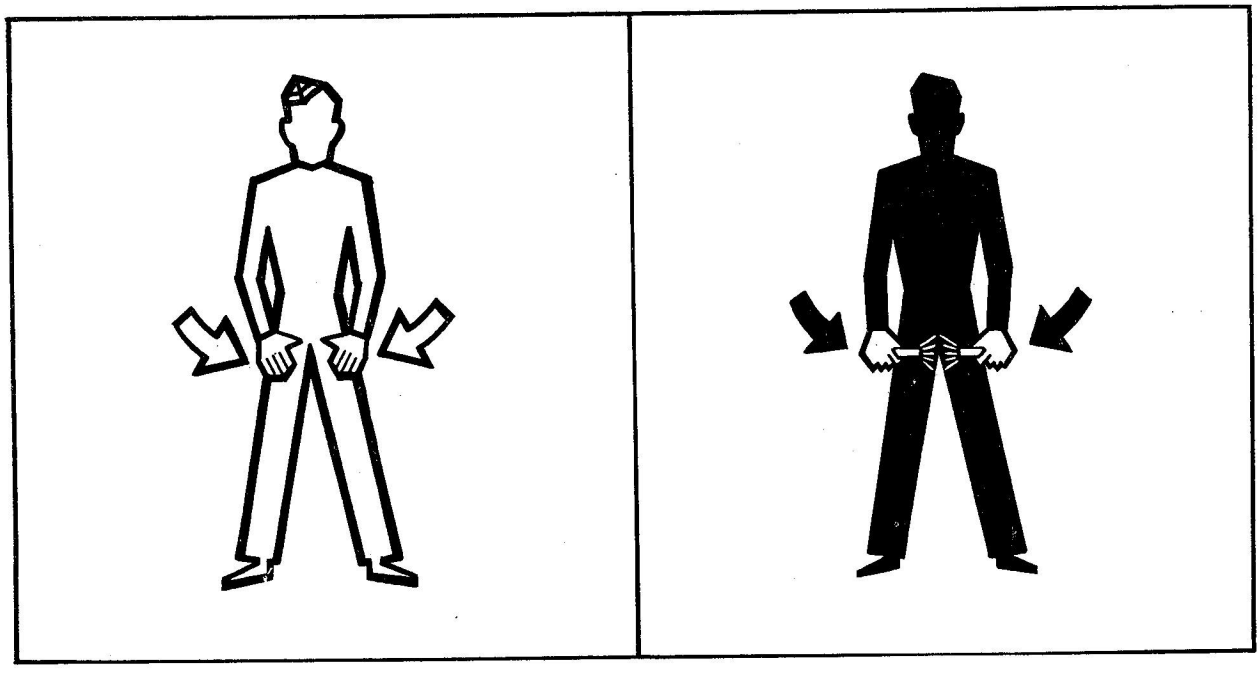
Right arm down, left arm repeatedly moved upward - backward. Speed of arm movement indicating rate of turn.

Figure 6 Turn to Port



Arms repeatedly crossed above head. - Rapidity of arm movement to be related to the urgency of the stop., the faster the movement the quicker the stop.

Figure 7 Stop



Arms down, palms facing inwards, swing arms from extended position inwards.

Figure 8 Insert Chocks

Avoid impact loading caused by jerking motion as this imposes double the amount of normal strain on the aircraft; in addition, tow bar shear pins may be over-stressed or sheared. Under no circumstances are personnel to jump on or from an aircraft while the aircraft is in motion.

(b) Where it is necessary to change direction of movement of an aircraft more than the prescribed maximum radius as laid down in the applicable aircraft -2 Engineering Order. The turn is to be made manually with the necessary precautions being taken as in (c).

(c) To prevent any undue strain being imposed on the aircraft, the tail wheel or nose wheel is not to be turned cross-wise whith the main wheel acting as a pivot, but the aircraft is to be moved forward or back with the proper minimum radius turning of the inside wheel being approximately five feet.

(d) Wherever possible, aircraft are to be towed forward rather than backward; however, where instructions are in the specific aircraft -2 EO for backward towing procedure, then that instruction shall take precedence.

(e) The appropriate towing bar for the specific aircraft is to be used on runways, tarmac or concrete aprons and hangar floors.

(f) Where the ground is uneven a towing bridle fixed to the towing lugs is to be utilized. On aircraft not equipped with towing lugs, and where conditions warrant rowing, the towing bridle is to be constructed of rope of sufficient strength for towing. The length of the towing bridle is to be approximately three and one half time the track of the aircraft.

(g) KNOT STRENGTH: The approximate strength of knots with the full strength of (dry) rope (-1000) is as follows: -

Eye Splice Over Iron Thimble	90
Short Splice in Rope	80
Timber Hitch	65
Round Turn and Half Hitch	65
Bowline	60
Slip Knot (Centre Loop)	60
Clove Hitch	60
Square or Reef Knot	50
Sheet Bend (Weaver's Knot)	50
Bight of a Rope	45
Figure Eight Knot	45

WARNING - Prior to towing any aircraft fitted with Jettisonnable takns and other external stores, ALL switches and circuit breakers controlling the applicable circuits must be in the "OFF" position, or pulled out in order to prevent accidental operation of the Jettison system.

Seaplanes

3 The general procedure for towing seaplanes shall be as follows:

(a) Hull Types:

(i) Bow (nose first where waves are turbulent, towing away or to a mooring buoy, wharf to or from a refuelling medium.

(ii) On long towing ensure all hatch covers are fitted securely to prevent ingress of water. The NCO in charge shall ensure that assistants are placed as follows: -

(a) Hull Types: - (five men required). One man in cockpit for maneouvering and anchor man in case of emergency. He is to be competent in starting engines in case of emergency. Two men for wing tip duties, competent in wing line throwing. One assistant, if necessary, on mooring barge or dock. One assistant, if necessary, to towing boat.

(b) Float Types:

(i) Bow (nose) first under all circumstances.

(ii) Bow (nose) first with towing boat lashed alongside of float. The NCO i/c shall ensure that assistants are placed as follows: -

(a) Float Type - (fivemen required). One man on each float competent in wing line throwing. One man in cockpit to assist manoeuvering of floats rudders. He is to be competent in engine starting in case of emergency. One assistant, if necessary, to towing boat. One assistant, if necessary, on mooring barge or dock.

4 Where pilots are available, the normal procedure may be used for mooring aircraft under engine power, in accordance with CAP 100, Vol,, Chap 105, Sect 1, para 105.02.

5 The normal specific aircraft towing bridle shall be utilised, however, where local manufacture of towing lines or marine moorings are necessary the following ropes may be used:

(a) 32A/43 - $2\frac{1}{4}$" Diameter Manilla Hemp Federal Spec TR601 A - rot proofed for marine mooring and tow lines.

(b) 32A/33 - 3" Diameter Manilla Hemp Federal Spec TR601 A - rot proofed for marine mooring and tow lines.

CARRYING OF VOLATILE AND INFLAMMABLE FLUIDS IN RCAF AIRCRAFT

1 The carrying of suppliesof any volatile and inflammable fluids in aircraft, to supplement that aircraft's requirements, is to be restricted to flights where:

(a) The normal capacity of the aircraft tank(s) is not sufficient to complete the flight.

(b) An RCAF Source of sup ly is not available prior to the return to the aircraft's base.

2 Where supplementary supplies of these fluids are required to be aboard an aircraft in accordance with the above paragraph, the following instructions are mandatory:

(a) The Captain of the aircraft is to be notified prior to the intended flight.

(b) Containers shall be to RCAF Reference 40D/141, five US gallons containers with flexible spout, or equivalent. There is to be a minimum of 10% air space allowed for expansion of the fluid.

(c) Containers are to be securely stowed and grounded in a ventilated compartment away from electrical equipment or from other equipment liable to cause combustion.

(d) Containers shall be removed and stored from the aircraft on completion of each flight.

3 Containers are to be marked (stencilled) as to contents.

CORROSION CONTROL

FORMS OF CORROSION

General

1 There are four main forms in which corrosion will be encountered and it is the purpose of this Engineering Order to air personnel in identification, to take the necessary action to remove the corrosion and to inhibit the surface to prevent further corrosion. Corrosion when encountered will be in one of the following forms:

(a) Intragranular (Surface) Corrosion

(b) Intergranular (Intercrystaline) Corrosion

(c) Dissimilar Metal (Electrolitic) Corrosion

(d) Stress Corrosion

Intragranular (Surface Corrosion

2 This is by far the most common form of corrosion which will be encountered in the RCAF, and early recognition of the sysptoms is essential in combating this corrosion. The tell tale dirty white blotches which form on the skin are very evident in the picture, and indicate that preventive action should be instigated immediately.

3 Areas which are the most susceptible to this form of corrosion are the undersurfaces of wings and tailplanes, lower portions of air intakes, the areas around the battery compartment and areas subjected to relief tube spray, hot exhaust gases and the gases from gun fire. These areas should be inspected at regular intervals for any indication of corrosion.

4 In Figure 1-2 we see a panel which has been allowed to proceed to a serious degree. The left hand side of the picture shows the surface appearance before the corrosion product has been removed, while the right hand portion of the panel has been cleaned and tested for penetration. The test for penetration is carried out using a 5 normal solution of sodium hydrozide, caustic soda, 1 part to 4 parts water by weight, which is applied to the surface and left for 2 mintues. Using a flashlight and a magnifying glass, 4 power or greater, inspect the base of the pits to see whether they have turned black. If the base of the pit is black, it indicates that the clad has been penetrated and that either the panel should be replaced or a form of surface treatment carried out. For recommended surface treatments, see Part 2. It will be left to the discretion of theChief Technical Officer as to whether the panel will be replaced or surface treatment carried out.

5 In the case of extruded members or castings, the extent of corrosion allowed will depend upon the location and function of the member involved. In all cases the Chief Technical Officer will decide what program will be carried out. A suggested maximum reduction in cross sectional area due to the action of surface corrosion in 10%.

INTERGRANULAR (INTERCRYSTALINE) CORROSION

6 A second and perhaps the most serious form of corrosion which will be encountered is intergranular or intercyrstaline corrosion. The corrosion is more prevelent in the heat treatable aluminum alloys such as 17S, 24S, 57S, (52S Alcoa) and 75B, which has been subjected to improper heat treatment. In Figure 1-3 we have a photograph (x500) of a longitudinal section of a sample which has been improperly heat treated. In this photograph, it is possible to see the precipitation in the gran boundaries. It is this precipitation of alloying ingredients in the gran boundaries of the material which seriously decreases the materials' resistance to corrosion.

7 The first indication that corrosion is beginning to attack a member will be the formation of slight blister-like raises on the surface of the metal. Upon probing with a shape tool the metal will flake away much like rotten wood. Figures 1-4 and 1-5 show the appearance of a member after probing in which corrosion has reached an advanced stage. In Figure 1-6 we have a cross sectional view of a member which showed only a slight blister effect on the upper surface. The member when sectioned and subjected to microscopic examination showed the effects of severe intergranular corrosion. As shown, Figures 1-6 and 1-7, the effect of intergranular corrosion, dark lines, is to destroy the gran boundaries which in turn reduces the strength of the material. The fact that intergranular corrosion can reach a serious extent before being evident, makes it essential that when this form of corrosion is suspected, steps are taken to determine the extent of the damage. In Figure 1-8 we have a longitudinal cross section of a section of corroded metal showing the complete breakdown of grain structure which has occurred.

8 The use of clad sheet has, to some extent limited the danger due to improper heat treatment. However, if surface corrosion is allowed to penetrate the clas on a section which has been improperly heat treated, intergranular corrosion will attack the base metal. This action may be seen on Figure 1-9 where corrosion lines may be seen extending from the base of the pits. With clad material, corrosion may proceed until the only sound metal is the clad. in Figure 1-10 we have an example of this, but in this photograph the outer clad has been removed to show the extent of damage to the base metal.

NOTE: There isno known method of inactivating this form of corrosion. The only corrective action that may be taken is the replacement of the affected components.

DISSIMILAR METAL (ELECTROLITIC) CORROSION

9 A third form of corrosion encountered will be that caused by the contact of two dissimilar metals in the presence of an electrolyte, a solution capable of conducting an electric current. It has been established that every metal and alloy has an inherent electrical potential, and when one metal is in contact with a metal of idfferent potential, in the presence of an electrolyte a galvanic cell is produced, and a current will flow from one metal to the other, resulting in the dissolution of one of the metals. The metal from which the current flows is the anode and that to which the current flows is the cathode. The degree of corrosion may be estimated from the difference in potential between the two metals forming the cell with the anodic, negative, metal being corroded. Table 1 lists the galvanic series in sea water, but is not true in every respect since corrosion is proportional to the current flowing in the cell and this is influenced by cell resistance, ratio of contact areas, concentration, aeration, and type of corrosive medium.

TABLE 1 GALVANIC SERIESIN SEA WATER

1 Magnesium
2 Magnesium Alloys
3 Zinc
4 Aluminum (52SH, 61S, 3S, 2S, 53ST in this Order)
5 Clad 24ST and Clad 17ST
6 Cadmium
7 Aluminum (75ST, A17ST, 17ST, 24ST in this Order)
8 Mild Steel
9 13% Chromium Stainless Steel Type 410 (Active)
10 50-50 Lead-Tin Solder
11 18-Stainless Steel Type 304 (Active)
12 Lead
13 Tin
14 Manganese Bronze
15 Naval Brass
16 Nickel (Active)
17 Inconel (Active)
19 Admiralty Brass
20 Aluminum Bronze
21 Copper
22 70-30 Copper-Nickel
23 Nickel (Passive)
24 Inconel (Passive)
25 Monel

NOTE: A passive metal denotes a metal upon which a protective oxide film readily forms, that prevents further attack on the metal.

Table 1 is for information only. The positions of the metals in this Table does not enable the rate of corrosion to be determined.

Stress Corrosion

10 This type of corrosion occurs when a particular member is subjected to both high stresses and corrosive conditions. This form of corrosion happens infrequently and is evident by the metal cracking in the areas of maximum stress. Aluminum, brass and magnesium alloys are particularly susceptibel to this kind of failure. Stress corrosion will occur along lines of cold working if the metal has been tressed too highly and not properly relieved through heat treatment.

CORROSION CONTROL

General

1 It is of the utmost importance that aircraft be kept thoroughly clean at all times. Whenever flying commitments permit a definite time should be set aside for cleaning aircraft. This cleaning of aircraft is considered essential in order to maintain airworthiness and to inhibit corrosion. In order to avoid damage to the aircraft through use of harmful materials, only those materials which have received AMCHQ approval are to be used. In washing aircraft and in paint removal from metal surfaces, care must be exercised to maintain the proper concentration of solution used, as a strong solution may be found to cause corrosion.

Cleaning

2 Instructions and approved methods for cleaning aircraft as detailed in EO 50-10A-2 Aircraft Cleaning External are to be followed.

Salt Water

3 Aircraft involved in operations from salt water shall be washed down with fresh water at the end of the days flying. Components not otherwise protected against corrosion shall be dried and either sparyed or wiped down with lubricating oil or hydraulic fluid depending on components being treated. Care shall be taken to ensure that as little fluid as possible is deposited on exhaust pipes or collector rings. The fluid will also be kept off all rubber components.

4 Magnesium or aluminum alloys are used in the landing gear wheels and unless protected, corrosion will set in rapidly. Inspection of the wheels should include a careful visual inspection of the paint surface. Portions of the wheel where the paint has deteriorated, peeled or chipped must be retouched with lacquer.

5 Hull and float interiors will be drained and flushed at regular intervals and in manner described in the applicable -2 Engineering Order.

Metal in Contact

6 When fabricating metalic parts, care must be exercised to prevent corrosion at the faying surfaces. Similar metals present no difficulty and require only the use of zinc chromate primer before fabrication. The use of dissimilar metals present a much more difficult situation and precautions must be taken. In most instances the materials should be separated by an insulating material. Steel when in contact with aluminum should be cadmium plated or metalized with aluminum and then receive two coats of primer which must be dry before assembly. The installation of press fittings in accomplished using a heavy zinc chromate paste.

Battery Acid

7 To neutralize spilled battery acid, use sodium bicarbonate, baking soda, or sodium borate, borax, dissolved in water. The alkali salt must be completely removed after neutralization with copious quantities of water to prevent corrosion.

Gun Blast Panels

8 Gun blast panels and areas which the hot gases pass over shall be cleaned with an approved cleaner at the end of the days' flying, if the guns have been fired.

Removal of Corrosion Product

9 There are several means of removing the corrosion product, but care must be used to ensure that no further damage is done to the skin. Mechanical methods of removal may be one of the following; sandpaper, scrapers, wire brushing, aluminum wool.

NOTE: In no case shall steel wool be used in removing corrosion product from aluminum panels. The use of steel wool may cause electrolitic corrosion due to particles of steel wool embedding in the aluminum clad.

NOTE: Whenever possible chemical means of removing the corrosion products are preferred to mechanical means.

CORROSION REMOVAL - ALUMINUM

Chromic Acid Wash

10 A 10 % solution shall be made by mixing 18.5 ounces, Avoirdupois, chromic acid Federal Spec. O-C-303 in 1 Imperial gallon of water. Stir the solution until the chromic acid is throughly mixed.

Procedure

11 The procedure for application of the corrosion inhibiting coat shall be as follows:

(a) Clean the affected areas thoroughly using an approved solvent

(b) Clean the corroded areas of corrosion product using the acid wash and stiff fibre brush.

(c) Wash the area thoroughly with warm or cold water to remove all traces of corrosion.

(d) Coat area with the 10% solution of chromic acid applied uniformly with cloths, felt pads or brushes and allow to dry. This will act as an inhibitor.

(e) The chromic acid shall be thoroughly removed with a damp cloth and the metal dried. This is necessary to prevent staining of the finish.

CAUTION The operator must wear protective clothing while carrying out this operation.

The chromic acid solution must be limited to a chromic acid content of between 9 and 11 percent. This corresponds to a hydrometer reading of 1.068 to 1.084.

Rags wetted with chromic acid solution shall be placed in a metal container to avoid the possibility of fire caused by spontaneous combustion.

Acid solutions are to be contained in glass or earthen ware containers.

Reference is to be made to EO 00-25-24 for further precautions when handling acid solutions.

Phospheric Acid Treatment

12 A 10% phosphoric acid alcohol solution shall be prepared by mixing the following:

Isopropyl Alcohol	7 parts by volume
3-GP-525	
Phosphoric acid 85%	1 part by volume
Federal Spec. O-P-313	
Water	2 parts by volume

Procedure

13 The procedure for application of this corrosion inhibiting coat shall be as follows:

(a) Clean the affected area thoroughly using an approved solvent.

(b) Apply the acid solution with a stiff fibre brush, scour to remove all traces of the corrosion product. Allow the solution to remain for 2 or 3 minutes.

(c) Wash thoroughly with hot or cold water and dry.

WARNING: Phosphoric acid treament in general has the same application as the chromic acid treatment but should not be used where it could become entrapped and remain in contact with the structure as it will cause severe corrosion.

DO not allow material to remain on the surface more than 3 minutes.

Corrosion Treatment of Magnesium Alloy

14 A solution is prepared using 20 percent chromic acid Federal Spec. O-C-303, 1 percent silver nitrate and 79 percent water. This solution is maintained at a temperature of 49°C to 65°C (120°F to 150°F). The corroded magnesium parts less all brass or copper inserts are immersed in this solution for from 5 to 30 minutes depending on the time required to dissolve the corrosion product. Remove from the solution, wash in fresh water and dry. Immediately prime the parts with 2 coats of zinc chromate primer Spec. MIL-P-6889A Type 1, coat them with lacquer Spec MIL-L-7178.

15 Parts which cannot be dipped may be treated by removing as much of the corrosion product as possible with a stiff brush. Swab a generous quantity of the following freshly made solution: -

Sodium Dichromate	1.8 lbs
Nitric Acid, Federal Spec. O-A-88	1.8 lbs
Magnesium Sulphate	25 lbs
Water	1 Imperial Gallon

16 This chromic pickle solution is left on for 1 to 3 minutes and then the parts are throoughly washed with fresh water and brushed with a stiff bristle brush. If the coating on the metal when brushed assumes a bright yellow colour, an excessive amount of nitric acid is being used. Remedy this immediately by adding sodium dichromate to the solution.

NOTE: When applying this chromic pickle solution, precaution must be taken to ensure this solution does not come in contact with areas where injurious effects may occur, such as plated surface, bearing surfaces, brass or copper.

Surface Protection

17 Where additional surface protection is necessary zinc chromate primer Spec. MIL-P-6889A type 1 shall be used followed by a cellulose nitrate lacquer Spec. MIL-L-7178.

LUBRICATION OF THREADS

General

1 When a threaded light alloy part is screwed into another light alloy section, the threads unless properly lubricated are liable to bind. This is particularly noticeable if the parts are overtightened.

2 It is essential that the proper lubricatn is used. Threads are to be lubricated with lubricant, anti-seize, RCAF Ref. 34A-167. This compound is resistant to oil, gasoline, hydraulic fluid and alcohol.

3 Care is to be taken when assembling hydraulic lines that an excess quantity of lubricant is not applied as contamination of the hydraulic fluid will result, with possible malfunction of the system.

Oxygen Systems

4 Threaded light alloy components used in s stems carrying oxygen under pressure, when assembled, must be lubricated with compound, antiseize and sealing (for Oxygen systems) RCAF Ref 34A/127.

CAUTION: When assembling systems carrying oxygen under pressure no other form of lubricant shall be used.

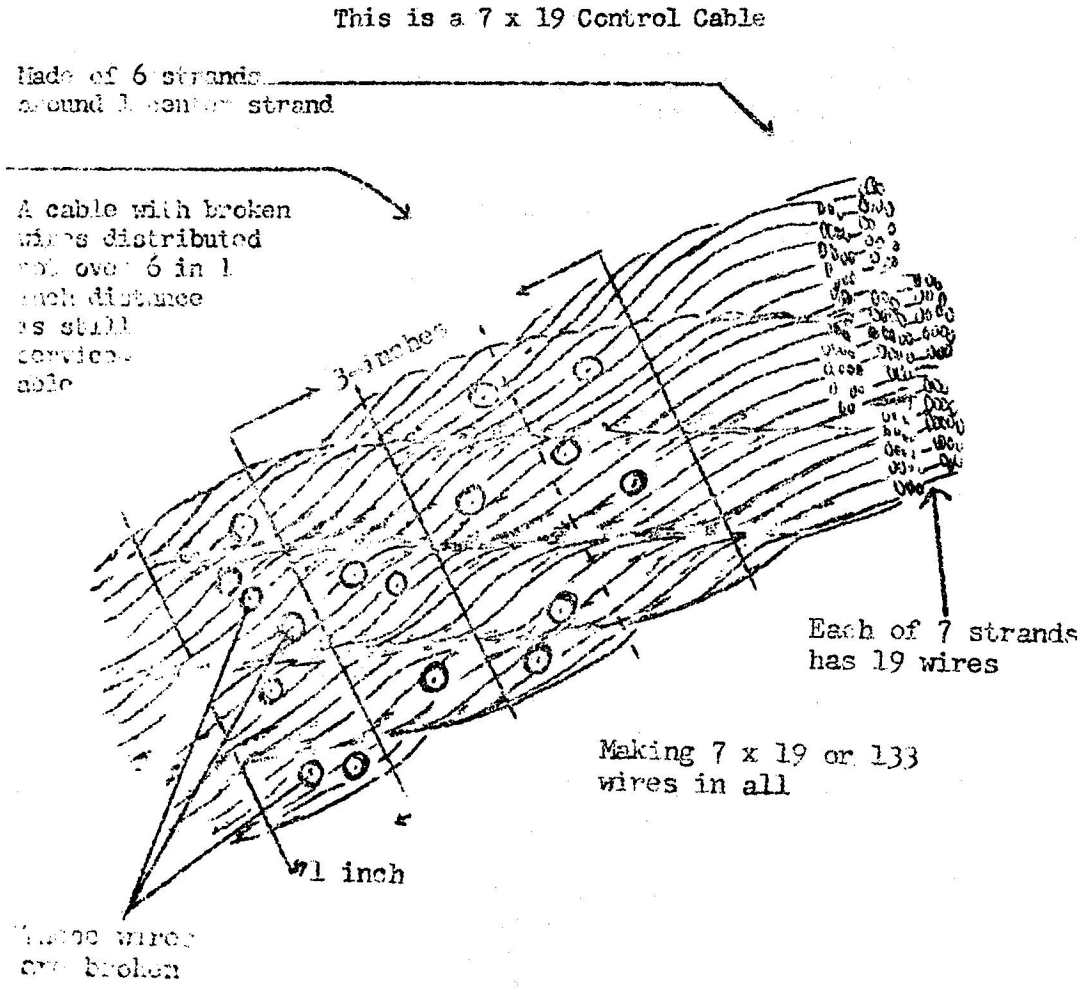


Fig 1 A cable with 7 or more wires broken within a 1-inch distance must be replaced

AIRCRAFT CONTROL CABLE TENSIONING - GENERAL

1 Where aircraft cable tensions are suspected of inaccuracy and effecting their intended role, the aircraft is to be brought into the hangar and allowed to remain in the constant-temperature area for as long as possible, before commencing cable tensioning, to ensure that the temperatures of the aircraft structure are stabilized.

2 To achieve best results, the aircraft should be placed in the hanger or in the shade, never in the direct sunlight. The aircraft should be shielded from draughts or hot-air blasts from h eaters.

3 Temperature readings should be taken from the interior of the wheel wells as the temperature changes morerapidly at this point than that of the internal airframe structure.

4 The following are suggested points to check to obtain the best results:

(a) Errors inherent in the measuring instrument; calibration is generally accurate with five percent. Avoid shocks or jarring of the instruments.

(b) Errors in temperature readings; two categories cover this phase, namely, human errors which can be corrected by rechecking readings, and errors due to unequal heating or cooling of the aircraft.

(c) Errors in the method of taking readings; take several readings at the same location and avoid snapping of instrument from the cable.

(d) Errors in positioning of the tensiometer; ensure that the cable is held firmly against the back of the tensiometer, when placed on the cable. Do not position the tensiometer within six inches of any type of cable connections as these increase the stiffness of cable resulting in high readings.

(e) Errors in the control positioning; neutralize the controls.

(f) Errors in the use of risers; ensure risers are retained for the particular instrument of all times.

5 This Engineering Order shall be used in conjunction with the applicable aircraft -2 EO. Engineering Order 65D-20AA-2 may be referenced for further information on cable tensiometers.

PRECAUTIONS WHEN INSTALLING "Q" RINGS, GLANDS, PACKINGS

General

1 To ensure that the correct type of gland, "Q" ring, packing etc., (synthetic or natural rubber) is used with the correct type of fluid (Mineral or vegetable base) in hydraulic systems.

Procedure

2 Soak the glands, "Q" rings, packings etc., in the type of fluid that the system used for at least 10 hours.

3 Check for swelling immediately after soaking. If the swelling exceeds 3% of original size the glands are to be rejected.

MULTI-WHEEL UNDERCARRIAGE UNITS ALTERNATIVE RAMP METHOD FOR WHEEL CHANGING

General

1 To effect wheel changes on aircraft with multi-wheel undercarriage units when handiness and speed are a factor, or when normal aircraft jacking equipment is not available, the following method may be used as an alternative to the normal wheel changing procedure as laid down in the applicable aircraft -2 AFEOs. This method is sueful when soft terrain or surfaces are encountered, as the large base area of the platform provides an adequate bearing surface.

2 This method of wheel changing may be employed only when the air craft will be so supported for a relatively short period of time.

Equipment

3 The ramp can be manufactured locally from available unit lumber supllies The general size and height of the ramp and shocks will be dependent upon the aircraft wheel and tire size. Suggested material is pine studs covered with sheet plywood.

Procedure

4 The front chock is secured in place to the main platform by inserting the anchor bolts. The inclined portion of the ramp is then placed at the rear of the platform and the aircraft carefully towed forward until the sound wheel is fully supported by the ramp and the wheel to be changed overhangs the platform. The rear chock is then pinned into place to prevent reaward movement of the wheel on the ramp.

5 The ramp must be of sufficient height so the unserviceable wheel is free to rotate or can be easily removed without obstructions.

6 After the wheel change is accomplished the inclined ramp is placed in front and the front ramp chock removed to permit the aircraft to be towed forward off the platform.

7 Under emergency conditions, when no aircraft towing facilities are available, the aircraft may be taxied onto and off the wheel ramp.

AIRCRAFT ALIGNMENT AND SYMMETRY CHECKS

General

1 The instruction details the general procedure to be followed and the equipment required when performing aircraft alignment and symmetry checks. In addition, an alternative symmetry check method is detailed using a water-level method.

2 This order is to be read in conjunction with the applicable aircraft -2 or -3 Engineering Orders. Aircraft diagrams, required dimensions, special instructions and special equipment required will be detailed in the applicable aircraft EO.

Definitions

3 An alignment check involves the measurement of distances between reference points on the aircraft and distances between reference points projected from the level aircraft to the floor plane.

4 A symmetry check involves the measurement of elevations to reference points on a level aircraft relative to a horizontal reference plane.

5 These measurements are then checked against the established dimensions as laid down for the applicable aircraft.

6 Alignment and symmetry checks shall be performed when any of the following conditions have occured:

(a) Heavy landing

(b) Abnormal loads have been placed on flying surfaces and/or fuselage due to the "G" limits being exceeded, or other causes.

(c) After a major overhaul

(d) When a major structural component is changed.

(e) When the flying characteristics of the aircraft are such as to cause doubt in the correctness of the aircraft alignment.

7 A visual inspection of the aircraft shall be carried out after a heavy landing or when there is possibility that "G" limitations of the aircraft have been exceeded. Special attention is to be given the following (where applicable) for signs of cracks, ripples or failure:

(a) Power plant mounting

(b) Tail pipe supports

(c) Centre section fairings.

(d) Slats

(e) Drop tank attachment points

(f) Flying control surfaces and the hinge points.

(g) Fuselage and wing skin.

(h) Popped or pulled rivets or sheared bolts.

Equipment Required

8 The following list of equipment is only of a general nature. Special equipment required will be detailed in the applicable aircraft engineering order:

(a) Wing jacks and pads.

(b) Nose or tail jack and pads.

(c) Spirit level and levelling bar

(d) Two-foot scale.

(e) Six-foot scale or rod.

(f) Six-foot steel tape.

(g) Fifty-feet steel tape.

(h) Two plumb bobs and lines.

(j) Chalk line and chalk.

(K) Transit or surveyors' level.

Alignment Check

9 Both alignment and symmetry checks are to be performed in still air and preferably on ahard, smooth, level surfaced floor.

10 With the aircraft located on a ahrd level surface, proceed to jack the aircraft and level it in the longitudinal plane using the spirit level and levelling brackets. Similarly adjust the lateral level of the aircraft by means of the wing jacks. Check the longitudinal and lateral level to ensure the aircraft is accurately levelled before any measurements are taken.

11 Using the applicable aircraft diagrams, locate the required reference points on the aircraft and project these points to the floor plane using the plubm bob and line. Mark and connect these projected points using a chalk

line to mark the floor. Measure and record the distance between the connected reference points using the steel tape, which has been pulled taunt before measurements are taken. Check the dimensions obtained and compare those with the dimensions quoted in the applicable Engineering Order.

NOTE: If discrepancies are found between actual dimensions and those quoted in the applicable Engineering Order, a structural check and investigation must be made to determine the cause.

Symmetry Check

12 Level the aircraft in the same manner as that detailed in paragraph 10. Locate the transit or surveyors level on the right-hand side of the aircraft midway between the wing tip and tailplane. Ensure that the site chosen is such that the line of sight to the datum point and right-hand reference points is not blocked by parts of the aircraft or jacking equipment.

13 Locate the aircraft datum point and place a steel rule against it, ensuring that the rule is at right angles to the plane of the floor by means of a plumb bob held against the aircraft near the datum point. Take a sight through the level on the rule and record the reading. Repeat this process for all right-hand reference points and record the readings.

14 Move the transit or level to the left-hand side of the aircraft and repeat the procedure as outlined in paragraphs 12 and 13 for all left-hand reference points.

15 The actual dimensions between the datum point and the reference points are obtained by subtracting the datum point reading from each of the recorded reference point readings. The plane of the datum point is considered as the zero dimension. In the calculation of vertical measurements, a positive value indicates the reference point is above the datum point, and a negative measurement indicates the reference point is below the datum point.

NOTE: If discrepancies are found between actual dimensions measured and those quoted in the applicable Engineering Order, an investigation must be made to determine the cause.

Symmetry Check - Water Level Method, see Figure 1

16 The following instructions detail an alternative means of performing an aircraft symmetry check where a transit or level is not available or is not practical. This symmetry check method is based on the principle that "liquid always seeks its own level".

Equipment Required

17 In addition to the equipment as detailed in paragraph 8, less item (k), the following equipment is required to carry out a symmetry check by the water-level method:

(a) Approximately fifty feet of plastic garden hose. Where possible transparent hose is preferable to facilitate the removal of all air bubbles from the hose.

(b) Two lengths of heavy walled glass tubing, such as water gauge tubes as used in steam or hot water boilers. If available, straight lengths of heavy plastic tube amy be substituted.

(c) Two standard twelve-inch steel rules.

(d) Two locally manufactured tripods, or lengths of two by two lumber approximately three feet in length. The ehight of the tripods or supports will be dependent on the aircraft being checked.

(e) A vegetable or mineral dye may be added to the water for water level contrast, if desired, e.g. ink.

Procedure

18 Fill the pastic hose with water ensuring that no air bubbles remain in the hose, as this condition would cause erroneous readings. Install the glass or plastic tubes in each end of the hose and top up the complete assembly until the water level in both ends in within three or four inches of the open tube end.

19 Locate the aircraft datum point and support one end of the hose assembly under the point by attachment of the hose to the tripod or wooden support. Keeping the other end of the tube at approximately the same height move it to the reference point for which a measurement is required. The second tripod or wooden support is then used for the support of this end.

20 With the hose assembly set up as above, for each reference point that a measurement is required, measure the following:

(a) Distance from the datum point to water level.

(b) Distance from reference point to water level.

NOTE: Care is to be taken that the heights of the gauge tubes are not varied during the taking of measurements (a) and (b) above.

21 The acutal dimensions of the reference points required are obtained as indicated in paragraph 15.

EVANS CANVAS TROOP SEATS

General

1 To provide instructions for the proper setting and adjustment of Evans Canvas troop seats.

Description

2 Evans canvas troop seats are manufactured in four standard units, termed two -, three -, and four-, and five-man seats. Each unit can be installed separately, or, units can be variously combined to fit any space approved under the loading specifications of the aircraft, See Figs 1 & 2.

Setting up Seats

3 Carry out the following steps when setting up seats: -

(a) Unroll seat. All parts are readily accessible, see Figure 3.

(b) Attach spreaders, see Figure 4.

(c) Unfold legs, centre legs over floor plate, and press down to lock, see Figures 5 and 6.

(d) Attach seat back, see Figure 7.

Adjustment

4 Adjust seats as follows:-

(a) To alter the tension of the canvas seat, detach the leg from the floor plate and move the adjusting bolt as required. Three or more adjustment holes are provided. Centre for normal tension, upper (tight), or lower (loose), see Figure 8.

(b) To change tension of the seat back, adjust the supporting strap buckles.

CAUTION Do not place heavy, sharp-cornered objects upon the seats. Never stand or walk on seats.

Never tighten seat backs t rigid tension, thus forcing them to carry the seat load. Leave ample slack in the backs for reclining comfort. Remember that seat tension will increase somewhat during wet weather and slacken under dry weather conditions. Seats **should** be frequently inspected for proper tension and adjusted when necessary.

5 When replacing seats after removal from the aircraft, do not tighten rear tube clamps with seat spreaders in place and seat above normal horizontal seating position. Leave clamps loose, set the spreaders and attach legs at the floor plates. Then tighten clamps permanently.

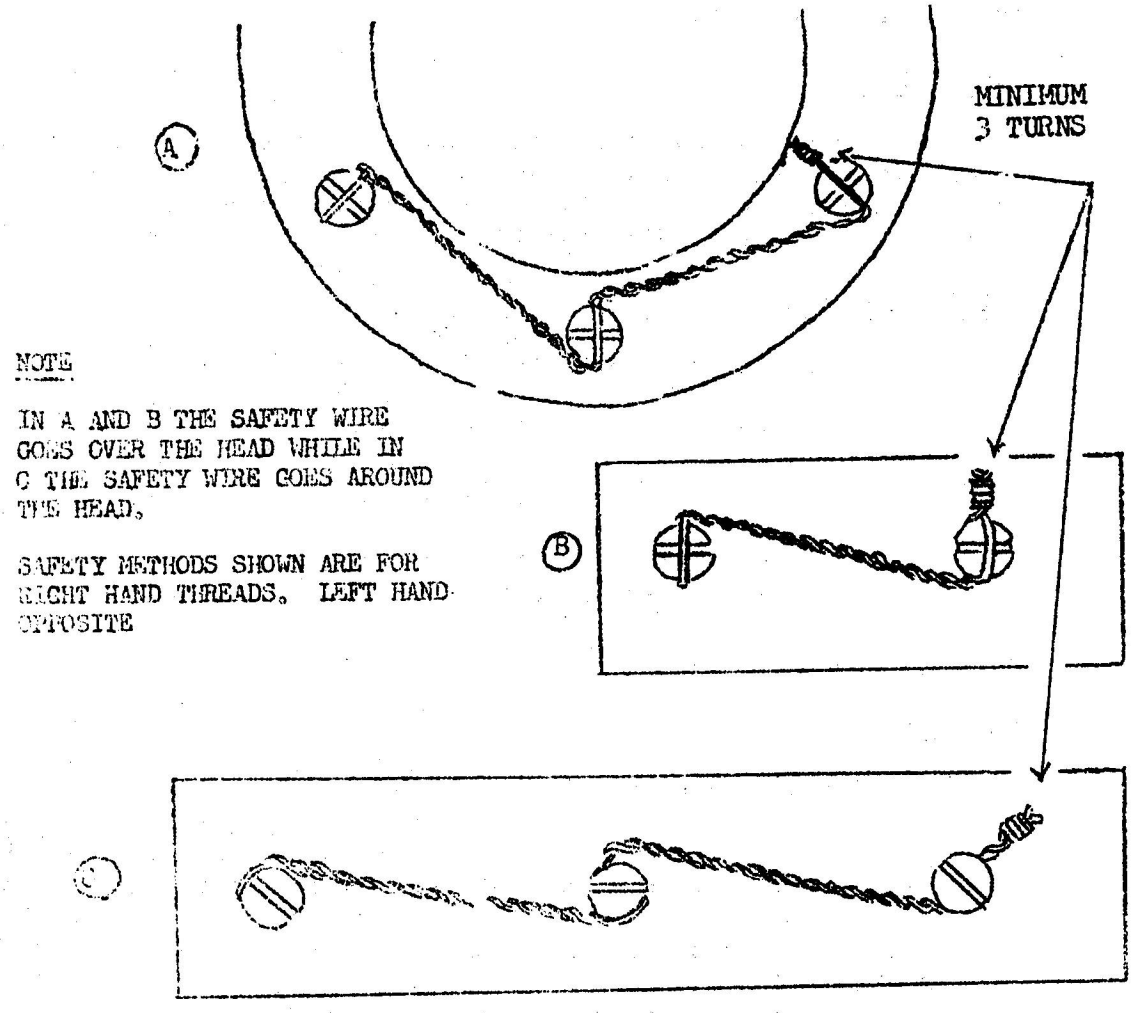


FIG 2 SAFETY WIRING

WIRE LOCKING GENERAL

General

1 Drilled-head holts, castellated or slotted nuts in series, fillister head screws, wing nuts, plugs, drain cocks, filler caps, valves and turnbuckles are to be safety wired. The following is a general application of safety wiring material recommended for the undermentioned purposes.

(a) Copper wire - Spec QQW341A, for locking emergency release devices, emergency and safety equipment.

(b) Brass wire- Spec QQW321 annealed, for general wire locking.

(c) Monel metal wire - Spec AMS4730B, for locking in heat areas between 200°F - 800°F.

(d) Inconel wire - Spec AMS 568730B - For locking in heat areas over 800°F.

IMPORTANT: This is a general instruction only. When wire is to be replaced the replacement wire, must be equivalent to the original specification used, or as called up in the engineering order related to the aircraft or the equipment concerned.

2 The size of safety wire for bolts, screws, wing nut, plugs, drain cocks and filler caps, unless laid down in the relevant maintenance manual or Engineering Order, is determined by the size of the hole provided for the wire. The wire should fill approximately 75% of the hole. When it is necessary to substitute monel wire for copper or brass wire the monel wire should be of such size as to fill 50% of the hole.

3 The length of wire required for general safety wiring is approximately 2 1/3 times the distance between the screw heads, nuts or plugs being safetied.

4 Copper wire (.020 inch maximum diameter) should be used for safety wiring emergency release devices. The size of the wire will depend upon the breaking or shearing load the operator is about to apply and should conform to the size recommended in the appropriate Engineering Order or as recommended by the manufacturer. Inconel or Monel wire should never be used in the locking of safety devices.

5 Safety wire must not be overstressed. Extreme care must be used when twisting wire, particularly when completing the final locking, to ensure that it is tight but not overstrained to the point where breaking will occur under slight load or vibration.

6 The finished end of the wire in a wire locking is to have a minimum of 3 turns (see Figure 1-1). The end is to be bent towards the body of the

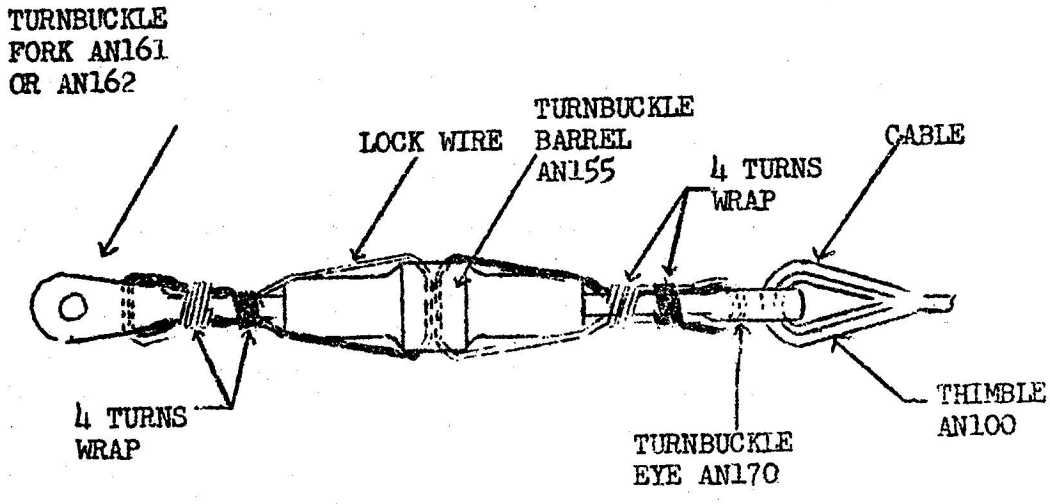


Fig 3. Barrel type Turnbuckle

fitting being safetied to prevent injury to personnel working on the equipment. For clarity the ends in Figure 1-1 are shown before being bent toward the body of the fitting.

7 Parts to be safety wired should be torqued to the recommended values before safety wiring. Loosening or overtorquing to align the safety wire holes is not permitted.

8 When safety wiring filler caps, plugs, valves, drain cocks, wing nuts and single drilled head bolts and fillister head screws the wire is anchored to an adjacent fillister head screw or anchorage lip when such is provided. When such provision is not available the safety wire is fastened to some adjacent part of the assembly.

9 When drilled-head bolts, screws, or other parts, are grouped together, they are conveniently safety wired to each other or in a series rather than individually.

(a) The number of bolts, screws and nuts, that may be safety wired together is dependent upon the application, and is generally determined by the length of wire that may be easily worked.

(b) Any number of bolts or screws may be safety wired together but as a general rule, a group of three or four is more convenient to handle and facilitates wire replacement.

(c) The methods by which these items are safety wired is shown in Figure 1-1.

(d) The wire is arranged in such a manner that if either a bolt, screw, or a threaded item begins to loosen, it will have force applied in the tightening direction.

SAFETYING OF TURNBUCKLES

1 In order to ensure the correct locking of turnbuckles, the following instructions are to be followed.

2 All lock wire used in the safetying of turnbuckles shall be nickel copper alloy (Monel Annealed) to Specification AMS 4730B. The minimum lock wire diameter shall be in accordance with the table shown here below.

3 Prior to safetying, both threaded terminals shall be screwed an equal distance into the turnbuckle barrel and shall be screwed in at least so far, that not more than three threads of any terminal are exposed outside the barrel.

4 After the burnbuckle has been adjusted to its locking position, two safety wires shall be passed through the hole in the centre of the turnbuckle barrel, and the ends of the wire shall be bent 90 degrees towards the end of the turnbuckle barrel, as shown in Figure 2-1.

5 The ends of the wire shall be passed through the hole in the turnbuckle eyes or between the jaws of the turnbuckle fork as applicable.

6 The wires shall then be ent back towards the centre of the turnbuckle and each wrapped four times around the shank, binding the wrapping wires in place.

7 When the swaged terminal is being safetied, one wire shall be passed through the hole provided for this purpose in the terminal, looped over the free end of the other wire and both ends shall be wrapped around the shank as shown in Figure 2-2.

8 When safety wiring English swaged type turnbuckles, as shown in Fig 2-3, not more that three threads are to be showing at each end. Also the ends of the wires will be given three complete twists before being considered in safety. All other English type turnbuckles shall be safetied in the same manner as AN turnbuckles.

Cable Diameter	1/16	3/32 or 1/8		5/32,	3/16,	7/32,	1/4	9/32 or 5/16	
	5S	16S							
Turnbuckle	8S	16L		-32S	-32L	-46S	-46L	-80L	-125L
AN 155 Dash No1	8L	-32S		-175L					
		-32L							
Lock Wire									
Min. Diameter	.020	.032		.040					

HYMATIC ANTIFREEZER

Purpose

1 Air supplied by the compressor contains a certain amount of moisture which after compression and cooling, condenses and if the temperature is below freezing point may form ice in the system. The object of the anti-freezer is to introduce alcohol vapour into the system for the purpose of lowering the freezing point of the moisture content. By admitting the vapour into the delivery side of the compressor a low consumption of alcohol is obtained through the air pressure preventing rapid evaporation at altitudes as would occur if the antifreezer were on the inlet side.

2 The antifreezer should only be used when there is a likelihood of freezing, and under normal conditions there is no need to fill the unit.

Loading Particulars

3 The leading particulars are listed in Table 1.

Capacity

4 Whilst the normal capacity is 150 cc, further development has shown that for nonacrobatic flight, 300 cc of methanol can be used, which is sufficient for 10 hours' operation, (methyl alcohol 34A/222).

Description

5 A light alloy body into the lower end of which is screwed a stainless steel drain valve seat, acts as a small reservoir for methanol. A top cap with inlet and outlet unions arranged horizontally is screwed into the other end of the body. In the top cap, a filling plug and dipstick combined is fitted, the dipstick consisting of a black rubber rod.

TYPE	WORKING PRESSURE	UNION CONE	PIPE SIZE	DRAIN TYPE
AF 3C	600 psi	External	$\frac{1}{4}$" BSP	Long nipple
AF 3D	600 psi	External	$\frac{1}{4}$" BSP	Long nipple
AF 3E	600 psi	Internal	$\frac{1}{4}$" BSP	Standard nipple Long drain nut
AF 4	1000 psi	External	$\frac{1}{4}$" BSP	Long nipple
✱ AF 4/2	1000 psi	External	5/16" BSP	Long nipple

✱ For use with supercharged compressor.

marked for the level of alcohol required. Drainage is effected by a nipple plug held in place on the valve seat by a valve nut. The nipple plug is extended to form a connection to which a flexible pipe can be attached for draining away the alcohol. A long drain nut is used on certain types to suit installation requirements.

Operation

6 The antifreezer is a small reservoir containing methanol, connected in the pipeline close to the compressor. The warm air passing through the unit becomes saturated with alcohol vapour and so prevents freezing throughout the pneumatic system.

Installation

7 The antifreezer should be so mounted so as to allow easy access for drainage and refilling.

Daily and Periodic Inspection

8 See paras 4, 9, and 12 to 15.

Daily

(a) Drain and refil. (The antifreezer is used only when there is likelihood of freezing). Check for leakage at drain and filter plug after drainage or refilling.

100 Hours

(b) Check for leakage at drain valve, filler plug, unions, etc.

400 Hours

(c) Test and overhaul if necessary.

Dismantling

Items for Periodic Inspection

9 Drainage - It is important to drain the antifreezer every five hours' flying time even though the level appears normal, because the remaining alcohol will be diluted with condensed water and oil.

(a) Arrange a tin below the drain valve to collect the fluid.

(b) Slacken and remove the valve nut and vale, the fluid will drain out into the tin.

(c) Leave the valve assembly off until the antifreezer is drained. Alternatively, the nut can be slackened slightly which will allow the fluid to run past the valve seat and through the ports in the hollow nipple drain plug out into the tin.

10 Refilling - Before refilling, see that the drain plug has been replaced correctly in the bottom of the antifreezer.

(a) Unscrew and remove the filler plug and dipstick assembly ($\frac{1}{2}$" Whit. spanner) from top cap, taking care not to lose the rubber joint washer.

(b) Fill up to the correct level on the dipstick with high-grade acid-free alcohol. The capacity is 150 cc of methyl alcohol, see para 4.

General Overhaul

11 Unless leakage occurs at the joint between top cap and body, or at the valve seat and body joint, there is no necessity to dismantle the antifreezer, but if the occasion arises and tools and spares are available at Base Maintenance Workshop, the following procedure should be adopted: -

(a) Hold antifreezer body in bench fixture (B2807/F2).

(b) Remove locking ring from the groove around the bottom of the body.

(c) Slacken and remove bottom cover (drain valve seat) with special spanner (B2948/F1 tool list).

(d) Take off drain valve nut and nipple plug.

(e) The nipple plug can be released from the nut by withdrawing the split pin.

(f) Unscrew the two screws holding the locking tab to the body.

(g) The top cap can now be unscrewed and the inlet and outlet unionsremoved if required.

(h) Removal of the filler cap and dipstick assembly is explained in a foregoing paragraph.

Inspection

Items for Periodic Inspection Without Removal from Aircraft

12 Draining will be accomplished as follows:

(a) Check the antifreezer has been drained (as explained in para 9)

(b) See that the drain plug is replaced and tightened after draining.

(c) Test for leakage with soapy water, whilst system is pressurized.

13 Filling will be accomplished as follows:

(a) Check level of methanol (as explained in para 10)

(b) See that filler plug and dipstick have been replaced correctly and tightened.

(c) Check for leakage as explained in para 9.

14 Every 100 hours inspect for leakage as follows:

(a) Check for leakage at drain valve, filler plug, inlet and outlet unions and around top and bottom cover joints by brushing on soapy water. Bubbles will appear if leaking.

15 Inspect items on general overhaul - upper and lower as follows: -

(a) Examine all threads and joint faces for damage.

(b) Examine drain valve seat and nipple plug for marks or damage.

(c) Examine filler plug and dipstick subassembly for damage.

Rectivication and Re-Assembly

16 Rectify and re-assemble as follows: -

(a) If necessary, recut valve seat in the bottom cover using cutter (B2948/F2 tool list) taking a light cut only, leaving a seating free from chatter or marking.

(b) Hold body in bench fixture (B2807/F2 tool list).

(c) Screw in bottom cover with new "O" ring in place using special spanner (B2948/F1 tool list).

(d) Assemble nipple plug to valve nut and retain by split pin.

(e) Screw on valve nut to seat in bottom cover.

(f) Fit new rubber "O" ring to top cap and screw into body, tightening in position. Fit unions and dipstick assembly to top cap, using new joint washers in each case.

(g) After testing as explained in paras 17 and 18, drill though the antifreezer body at the recess provided for the locking ring, to a depth of 0.25" into the bottom cover with #44 drill.

(h) Fit locking ring with chain to body and connect chain to ring on valve nut.

TESTING

Test #1

17 Carry out test #1 as follows: -

(a) With a pressure guage connected to the air outlet union and a delivery pipe from a high pressure air supply on the inlet union, immerse the antifreezer in distilled water.

(b) Turn on the air supply and watch for bubbles from the joints.

Test #2

18 Carry out test #2 as follows: -

(a) Lift the antifreezer out of the water and open drain valve carefully until the air flows freely.

(b) Close the valve and again immerse in the water, bringing up air pressure in the antifreezer to 600 psi or 1000 psi according to type. No bubble shouls appear from the valve.

(c) If leakage occurs, clean up valve seat with cutter, as explained in para 16.

Tools

19 The same tools as for the Dymatic oil and water separator are suitable for the antifreezer.

(a) B2807/F2 - bench fixture.

(b) B2948/F1 - Spanner for drain valve body.

(c) B2948/F2 - Cutter for drain valve body.

LUBRICATION INSTRUCTIONS AND PRECAUTIONS

1 The instruction contained in this EO covers the general precautions to be observed in the handling and application of lubricants. Before the application of any lubricant is carried out, on RCAF equipment reference is to be made to the relevant EO. Excessive amounts are to be avoided in many applications, especially during extreme temperatures.

2 Separate dispensers, clearly labelled as to contents, are to be employed for each type of oil or grease in use. However, if sufficient dispensers are not available, one which has been used for another type of oil or grease may be utilized, provided that it is thoroughly washed with cleaner fluid, Ref 330/182, and dried before using.

Bearings

3 When applying oil or grease, other than the type previously used, the bearing, brushing etc, is to be washed with cleaner fluid to remove all traces of original lubricant.

4 Shielded ball and roller bearings are to be cleaned and greased by means of a lubricator anti-friction bearing, Ref 1B/1451, Alemite Pt 6212-A. This kit consists of a variety of clamping fixtures to fit all standard sealed bearings and is used as follows: -

(a) Fit the proper size clamp to the bearing.

(b) By means of a grease gun, force sufficient grease through the bearing to ensure that all the old grease is forced out.

(c) Spin the bearing to check for signsof roughness, sticking, or presence of grit. If any of these conditions exist, the bearing is to be rejected.

NOTE: Shielded bearings are only to be greased at reconditioning periods unless otherwise specifically detailed in the relevant aircraft EO, or, if doubt exists as to the condition.

5 Impregnated bearings (graphited bushing type) are not to be lubricated during maintenance inspections or reconditioning. They are to be cleaned at appropriate periodical inspections with a dry cloth only. No cleaning medium, such as cleaning fluid, is to be allowed to come in contact with these bearings.

Fairleads

6 Fibre fiarleads are to be kept dry and any grease or other lubricant previously applied is to be removed. Lubrication of fibre tends to cause the fibre to swell, causing binding of cables and excessive wear due to the accumulation of dirt and grit in the lubricant.

EO 05-1-2C

WOODEN AND FABRIC COVERED COMPONENTS

1 Aircraft with fabric covered components constructed of wood, which have become rain soaked due to being parked in the open for long periods, are not to be dried with hot air or other quick drying methods.

2 Aircraft are to be allowed to dry out naturally and ventilation should be assisted by opening or removing inspection doors and ensuring that all drainage holes are cleared as to allow the air to pass freely around the internal components.

3 Doped surfaces are to be maintained in good condition at all times. Whenever the dope is flaked off or shows signs of lack of adhesion, the parts affected are to be cleaned off and redoped in accordance with the current doping scheme of the aircraft, as soon as possible.

EO 05-1-2D

AIR VENTS - FUEL AND OIL TANKS - PRECAUTIONS

1 The following precaution is to be observed to prevent a partial vacuum forming in fuel and oil tanks, which often results in engine failure. Air ventsare to be inspected, to ensure they are clear, on every occasion when the aircraft is refuelled or oil tanks topped.

2 Common causes for clogging of air vent lines are, paint and dope smears, accumulation of dust and oil, ocrrosion and accumulation of frost and ice due to climatic conditions.

LOCKING OF CONTROLS USING AUTOMATIC PILOT TYPES A-3 and A-3A

1 The control surfaces of an aircraft are "NOT" to be locked, when parking, by placing the engaging lever of the automatic pilot in the "On" position as air will be introduced into the gyro pilot hydraulic system. The presence of air, in the system, results in spungy control action and must be removed prior to the use of the autopilot. Figure 1 shows how the effect of wind on the control surface, or the weight of the control surface itself will transmit a pressure on the servo pistons and thereby pump oil back through the drain system. To take care of the displacement of the servo pistons (figure 1) air will be introduced at the balance oil valve and through the gland of the servo piston rod.

2 A further reason for not favouring the use of the automatic pilot to lock the control surfaces is the possibility that pilotsmay inadvertently forget to disengage the engaging lever on the automatic pilot before take-off.

OVERHAUL, RECONDITIONING AND MAINTENANCE CYCLES

Maintenance

1 RCAF aircraft are maintained throughout their service life by periodic inspection and repair, or progressive replacement of failed, damaged or deteriorated components in accordance with RCAF Maintenance Schedules and other Engineering Orders applicable to each aircraft and itsequipment. Through this system it is intended that the technical serviceability of the aircraft be maintained for an indefinite period.

Reconditioning, Overhaul or Special Repair

2 In spite of normal maintenance and progressive replacement, certain components will deteriorate until rectification is beyond the capacity of RCAF maintenance organizations. The rate at which overall deterioration of an aircraft will occur depends on: -

(a) The rate of build-up of flying time.

(b) The role of the aircraft and conditions under which it is used.

(c) The standard of maintenance.

3 As the rate of deterioration may vary quite widely, it is impossible to lay down definite times, either calendar or flying hours, at which aircraft should be overhauled or reconditioned. The responsibility for airworthiness of an aircraft rests with the user formation. Therefore, the unit concerned is to recommend an aircraft for overhaul, reconditioning, or special repair when it is beyond unit capacity to maintain the aircraft in an airworthy condition.

Lifed Items

4 As a part of the process of maintenance by progressive replacement, certain items are assigned definite lives beyond which they must not be operated, whether or not they appear unserviceable at the time they are due for overhaul. The authorized lives of RCAF aero engines, propellers and rotors are given in Table 1. Lives of other "life" items, where applicable, are given in Part 9 of the relevent Maintenance Schedules.

Authorized Deviations and Tolerances

5 Commands and Groups may authorize periods of anticipation or delay of inspections, or engine or propeller-rotor removal subject to the tolerance given below, and any delegate this authority to specific units as required.

Inspections

6 Inspections may be anticipated or delayed by 10 percent of basic periodic inspections are due. Then inspections are anticipated by more than 10 percent the time of subsequent inspections must be advanced by the amount of the anticipation. No further delay of inspections is permissible except when authority has been granted by AMC for special operational or maintenance conditions.

Engine Removal

7 Time expired engines may be removed at the periodic inspevtion nearest to engine time expiry, that is, the engine time may be extended or shortened by an amount not exceeding half the minor inspection period. However, the period of anticipation of engine removal time must not exceed $12\frac{1}{2}$ percent of the engine life.

Other Lifed Items

8 Removal of other "life" items may be anticipated or delayed to permit removal at the periodic inspection nearest to completion of their authorized lives.

9 When special operational or other conditions require, Commands or Groups may, on the authority of their AOC, TEMPORARILY adopt an increased frequency of inspection or lower item lives. Where permanent change of inspection frequency or life seems desirable, recommendations should be submitted to AMC by UCR Form Stats 318.

TABLE 1

Aircraft	Engine	Overhaul Engine	Time Prop/ Rotor	Inspection Cycle
Auster	Gypsy 7-10Mk. 1-3-7G	1000	NA	50/500
Bristol 170	Hercules 734	800	1200	100/600
Bell 47D	Franklin 6VA-200-C32	600	M600 T300	30/300
Canso	P&W R1830-92-SIC3G	800	1200	100/400
Canuck	Orenda 2, 8, 10	100	NA	25/100
Chipmunk	Gypsy Major 1G, 7G, 10Mk 1-3	1000	NA	50/500
C119 Packet	Wright R3350-85	600	1200	100/400
Comet	Ghost 50 Mk 4 & WA	450 375	NA NA	75/1200
Dakota	P&W R1830-90C-90D-92	800	1200	100/400

Aircraft	Engine	Overhaul Engine	Time Prop/ Rotor	Inspection Cycle
Expeditor	P&W R985-AN14B	1200	1200	100/400
Hadrian Glider	NA	NA	NA	30/240
Harvard	P&W R1340-AN1-S3H1	1000	1000	100/500
Lancaster	Packard Merlin 224-225	400	1200	100/800
Mitchell	Wright R2600-13-29-29A	700	1400	100/350
Mustang	Packard Merlin V 1650-3-7	300	1200	50/300
North Star	RR Merlin 620-622	1000	2000	125/500
North Star C5	P&W R2800- CA15	800	1600	100/400
Norseman	P&W R1340-AN1	1000	1000	100/500
Neptune	Wright R3350-30W	600	1200	100/300
Otter	P&W R1350-AN2G-S3H1G-S1H1G-AN1	800	800	100/400
Piasecki H21A	Wright 1820-103 ✱	480	M-240	30
Sikorsky S51	P&W R985-AN5,B4	720	M-480 T-480	30/240
Sikorsky S55	P&W R1340-57-S1H2	600		60
Sabre 2 & 4	GE J47-13	300	NA	50/100
Sabre 5	Orenda Mk 10	100	NA	50/100
T33 Mk 1	Allison J33-A-35	600	NA	50/100
T33 Mk 2&3	RR Nene 10	500	NA	50
T34A	Continental O-470-13	600		50/300
Vampire	Goblin 2	450	NA	75/600

✱ Water Alcohol Injection

CONTROLS CORRECT FULL AND FREE MOVEMENT MANDATORY INDEPENDENT CHECK

1 The purpose of this AFEO is to ensure that no conditions exist which would result in malfunction of any aircraft control system, as a result of human error, defective material or misinterpretation of exisiting orders. To accomplish this purpose an " INDEPENDENT CHECK" as outlined in this AFEO will be mandatory when any part of the aircraft control systems is disconnected.

General

2 When it becomes necessary to disconnect any part of a control system of an aircraft, engine, canopy or ejection seat, whether direct or remote, every precaution is to be taken to ensure proper reconnection, correct locking, and operation in strict adherence to maintenance instructions in relevant AFEOs.

Independent Check

Responsibility

3 This INDEPENDENT CHECK is to be carried out by a qualified AE Officer, Warrant Officer, Senior NCO or qualified civilian of equal status who has not been employed in any manner on the adjustment or re-assembly safety locking, inspections and operation have been performed and in accordance with maintenance instructions and relevant AFEOs.

Procedure

4 The qualified person who is to carry out this INDEPENDENT CHECK on the control systems and/or components, is to satisfy himself that the adjustments, replacement, re-assembly, safety locking, inspections and operation have been performed and in accordance with maintenance instructions and relevant AFEOs.

Detail

5 The INDEPENDENT CHECK when carried out on a specific system shall in addition to the checks called for in paragraph 4 include the following checks as specified for that system: -

Flying Control System

(a) Following re-installation or replacement of any part of the system the components concerned whether direct or remote are to be carefully inspected and tested to be ensure: -

(i) Full and free travel

(ii) That the control surfaces operate in the correct direction relative to the controls. Particular attention is to be given to the installation of trim tab controls to guard against inadvertent crossing of controls.

Fuel, Oil and Hydraulic Systems

(b) On each occasion that it is found necessary to dismantle any section of remote controls used in fuel, oil or hydraulic systems, the cynchornization of the control in the cockpit is to be checked on re-assembly to ensure that the position shown on the indicator agrees with the actual position of the valve.

Ejection Seat and Canopy Removal Mechanism

(c) This mechanism requires a critical adjustment and it is essential that a thorough inspection be carried out to ensure proper adjustment, reconnection and security of all components in keeping with strict adherence to relevant AFEOs.

NOTE: It is also essential that all safety precautions reference EO 00-80-4/20, be observed when carrying out an independent check on ejection seat and canopy removal mechanism.

Engine Controls

(d) Following re-installation a thorough check is to be made to ensure that all quick disconnects and levers are properly engaged adjusted and locked and that all components operate in relation to control movement indicated in the cockpit.

Recording Action

6 When rectifying an unserviceability which concerns any system referred to in prargraphs 5(a), (b), (c), (d), the NCO signing the L14-1B in the "Inspected and passed; NCO in charge" column is to immediately make an additional entry in Column 3 as follows: "Independent check of (state control system affected) to be carried out in accordance with EO 05-1-2J".

7 Upon completion of the independent check by the qualifiedperson he is then to complete column 4 of the L14-1B as follows: "Independent check carried out in accordance with EO 05-1-2J", then stroke out the "Rectified By" column and sign in the "Inspected and passed; NCO in charge" column.

Additional Data

8 Locking devices such as split pins, locking wires and tab washers are to be used only once. When carrying out an inspection and/or replacement, reconnection, adjustment, refer to the following general EOs for:

(a) Safety wiring all aircraft, EO 05-1-2AQ.

(b) Aircraft control cable tensioning general, EO 05-1-2AK.

(c) Controls cables (7x19) replacement when frayed, EO 05-1-2N.

(d) (DELETED)

(e) Hydraulic system precautionary measures, EO 05-1-2A.

(f) Safety precautions - armament, EO 00-80-4/20.

(g) Fuel system operation and inspection of fuel selector valves and controls. EO 15-15-2A.

EO 05-1-2K

CARE IN ASSEMBLY OF STRUCTURAL MEMBERS

1 When assembling or dismantling aircraft st uctural members great care is to be taken to avoid damage or distortion by rough handling.

2 When inserting bolts through thin plates or tubes, undue force is not to be used. Driving of bolts will result in the bending outwards of the edges of the hole on the opposite side of the tube or plate. Over-tightening of bolts will cause inward bending of the edges of the holes.

3 Any mutilation of the holes in tubular members renders the members unserviceable and they are not to be fitted in this condition.

SELF-SEALING FUEL AND OIL CELLS PACKING, STORAGE, MAINTENANCE AND SALVAGE

General

1 The following instructions apply specifically to self-sealing fuel and oil cells of American design, in which the flexible layer is immediately adjacent to the contents. However, certain of the precautions listed apply equally to the British type of self-sealing tanks, in which the sealant layer is applied to the outside of a metal tank.

Packing

2 All cell openings are to be adequately covered with moisture-resistant adhesive tape or other suitable material to prevent entrance of foreign matter into the tank. The cell is to be supported in its crate with lint-free padded wooden supports which are to be arranged in a manner to ensure that no damage will result to the fittings or cell liner during shipment. Care is to be exercised when nailing the shipping crate together, to ensure that no nails protrude into the crate or the cell and that the fittings do not jam against or protrude through the crate. Instructions for correct handling and storage are to be clearly marked on the crate; e.g., USE NO HOOKS, THIS SIDE UP, and any other applicable instructions.

Storage and Handling

3 Since cells deteriorate with exposure to light and heat and through improper handling, the following instructions are to be rigidly conformed to by all concerned; -

(a) Store cells in a clean, dry, dark and cool place, away from operating electric motors with sump drains open.

(b) Always store cells in shipping crates. To ensure that these containers are available when required, they should be dismantled with care and stored after new or reconditioned cells have been removed from them for use. All personnel handling these crates are to exercise the degree of care consistent with contingent re-use.

(c) Crated cells are not to be stored over three high, if cells are not crated, they must be stored on suitable padded racks, resting on the largest surface, ie, in position in which it is installed in the aircraft. Care must be exercised to ensure that cells are not stored in any manner which may ause damage to protruding fittings.

(d) Suitable supports, padded with lint-free material, are to be installed inside semi-flexible cells, while stored to prevent their distortion. Where cells are equipped for external support, these are also to be fitted furing storage.

(e) Cell fittings or openings are not to be used as hand grips during handling or installation.

(f) When installing spare cells, always install first the cell which has been longest in storage.

Maintenance and Inspection

4 The following inspections are to be carried out on all aircraft equipped with self-sealing fuel cells: -

(a) Through inspection doors or drain openings, where practical, visually inspect the adjacent tank structure and all cell fittings and connections for signs of leakage, indicated by swelling, softening, or by a soggy, swollen or delaminated appearance. Leakage only occurs in a very advanced stageof deterioration, in which sealing layers of the cell are completely deteriorated.

Minor Inspection

(b) Check the fuel strainers for the presence of rubber particles. Any accumulation of rubber particles will indicate advanced deterioration of the cells, and a close inspection of the exterior and interior of the cells is to be carried out before declaring the aircraft serviceable.

Major Inspection

(c) The interior of each cell is to be inspected with the aid of a mirror and safety light through the filler neck, inspection door, fuel contents gauge opening, or sump for the following:-

(i) Diffusion of liquid through the synthetic liner, indicated in its initial stages by a swelling of the cell wall, with later stages recognized by a soggy, swollen or delaminated appearance.

(ii) Loosening of the seams of the liner.

(iii) Loosening of the fittings from the liner.

NOTE: If there is any indication of the above, cells are to be removed from the aircraft, properly crated and returned for repair of disposal action.

NOTE: On completion of the above inspection, a capacity check is to be carried out by comparing the amount of fuel required to fill the tank with the amount specified adjacent to the filler cap.

Removal for Overhaul or Other Reasons

(d) When removal of the cells is necessitated by overhaul or other reasons, they are to be inspected and re-installed, provided that they are in a serviceable condition. A self-sealing fuel cell should be considered beyond repair when: -

(i) The inner lining has become brittle due to leaching out out of the plasticizer by the fuel, and the effects of ozone. This condition can readily be detected by flexing the cell wall and observing if the inner liner exhibits any cracking beyond very slight surface cracking.

(ii) The cell wall contains a cut right through, greater than two inches in length.

(iii) The cell wall has been punctured and the sealant has been activated beyond a two inch radius from the puncture. Sealant activation may be detected by a swelling of the cell wall or alternately if the wall is soft to the tough.

NOTE: Self-sealing fuel cells have an indefinite life expectancy and should normally last the life of the aircraft.

Types of Cell Failures and Causes

5 The most common types of fuel cell failure associated with the normal service are: -

(a) Diffusion of liquid through the synthetic layer, causing sealing swelling and subsequent deterioration.

(b) Collapse of the cell.

(c) Loosening of the fittings from the liner.

(d) Leakage between cell and surrounding structure.

NOTE: These failures may generally be detected as follows: The diffusion of liquid through the synthetic liner, loosening of seams in the liner, and loosening of the fittings from the liner, found by visual and hand inspection of cell interior. Soft swollen area of cell surface, wrinkles in liner, or separation of the sealing layers from the liner, indicate leakage or diffusion of the fuel. The result of the capacity test noted in para 4(c) will indicate whether the cell has partially collapsed. Leakage of fuel between the cell and surrounding structure may be the result of improper attachment of fittings or parital failure of tank outlet connections. The first sign of failure of this nature in cells installed in a sealed structure will be collapse of these cells.

WARNING: When inspecting cells care is to be taken to ensure that cracking or loosening at the edges of the 1" trim tape is not mistaken for above-mentioned defects. This condition is known as ozone cracking and is not an indication that the cell is unserviceable. The only purpose which this tape serves is to give the fuel cell a finished appearance.

General Precautions for Removal and Installation of Cells

6 The general precautions outlined below are to be adhered to in all cases: -

(a) All inner supports and outside stiffeners are to be removed prior to collapsing the cells for installation or removal. These may be replaced by coating with soapy water. DO NOT DRIVE THEM INTO PLACE OR USE OIL OR GREASE.

(b) Ensure that all fittings are disconnected from the cell before removing from aircraft.

(c) When possible, cells are to be warmed to a temperature of 26.7°C (80°F) before collapsing and are to be left in a collapsed condition only as long as necessary for installation.

(d) Do not bend cells in the vicinity of fittings or inspection doors, or pry on rubber fittings with any tools.

(e) Before entering cells, remove all sharp instruments from pockets, remove shoes and cover bottom of cell with a heavy lint-free cloth. Light bulbs must not be allowed to come in contact with the interior of the cell. Compliance with the provisions of EO 00-80-4/7 is required.

(f) All openings must be covered when the cell is removed from the aircraft to prevent entrance of foreign matter.

(g) The torque to be applied to all fittings connecting screws is not to exceed 25 inch-pounds, regardless of the manufacturer's instructions. This torque limit does not apply to spider type fitting attachments, in which case the manufacturer's instructions apply. The above torque loading should be applied with a torque wrench, if available. However, a four inch spanner may be used in lieu of the torque wrench. The following procedure for connecting rubber moulded fittings is recommended:-

(i) Inspect fittings and threaded parts prior to installation to ensure freedom from foreign matter, damaged threads, or other defects.

(ii) Align mating surfaces so that screws or bolts can be started with minimum torque.

(iii) Distribute a sufficient number of bolts uniformly about the fitting to ensure an even seating of the mated surfaces.

(iv) Install the remaining bolts, then torque all bolts to the specified value, using a diametrically opposite sequence.

(v) If torque drops after bolts have been torqued to a specified value, do not tighten bolts to regain torque value; this is normal and is due to "cold flow" of the rubber fitting surface. Instead, loosen all bolts and completely retorque fitting.

NOTE: Excessive torques result in deformation of synthetic rubber, contributing to compound failure and fuel leakage. If after securing the fittings as directed, a leak is detected, the torque should be checked. If it has not fallen greatly below the initial torque, or below 20 inch-pounds, the mating surfaces should be examined for the cause of the leakage. Overtightening must not be resorted to as it will definitely result in failure of the fitting and surrounding cell area. This may not be evident on surfaces which are dry and have not been exposed to fuel, but when synthetic rubber is subjected to extensive compressive forces and exposed to the action of fuel, it will crack or chunk off over the mating surfaces and elaminate on the edges.

(h) Seam sealing materials, such as Prestite or Sealube, are not to be used as rubber to rubber and metal to metal applications for self-sealing cells. These materials contain solvent,

detrimental to synthetic rubber, and also have a lubricating effect on synthetic rub er, causing increased "cold flow". Should some of the paste accidentally get into the screw threads, and into the bottom of the blind tapping, the increased friction results in rapid torque build-up without corresponding cramping pressure on the fitting stalk.

WARNING: Personnel working with their heads in these cells, must use smoke respirators, or gas masks having a breather connected by a tube to the outside air instead of to the usually gas mask cannister.

Salvage

7 For salvage action proceed as follows: -

(a) the cells are to be removed from the aircraft as soon as possible.

(b) Before commencing slavage or entering the cell, it is to be completely drained, flushed and aired in accordance with procedure outlined in EO 00-80-4/7

(c) See procedure outlined in paras 6(b), (d) and (e).

(d) All serviceable parts, such as detachable fittings, are to be salvaged and stored with the cell for re-issue.

(e) After removal, the cells are to be immediately inspected by qualified pers nnel for evidence of damage or deterioration. Cells which show no such evidence are to be brushed or sprayed internally with engine oil. Ref. 34A/35, and tagged for re-issue.

(f) Cells which require repair will not be treated with oil. They are to be properly crated and returned for repair.

EO 05-1-2M

RETRACTABLE UNDERCARRIAGE - LOCKING

1 On an occasion when it is necessary to move an aircraft fitted with retractable undercarriage, positive indication is to be obtained that the undercarriage is locked in the DOWN position. Where the warning light or other indicator is not functioning, jury struts or dummy locks are to be used before the weight of the aircraft is moved on the undercarriage.

2 When an aircraft is used for ground instruction purposes, it is essential that undercarriage locks are used.

EO 05-1-2N

CONTROL CABLES (7 x 19) REPLACEMENT WHEN FRAYED

1 The following defines the limits of serviceability of frayed control cables (7 x 19) of RCAF aeroplanes in service at flying units. It is not applicable to aircraft being reconditioned or repaired by RDs or civil contractors.

2 The loss in cable strength, due to broken wires, depends more upon the concentration of wires at any point rather than on the total number in the cable; therefore, aircraft control cables (7 strand, 19 wires to the strand) are to be replaced when 7 or more wires are found to be broken in any 1 inch of length.

REMOVAL OF SNOW, ICE AND FROST FROM AIRCRAFT SURFACES

Introduction

1 Aircraft parked outside, during cold weather conditions are subject to being coated with snow, ice and hoar-frost on control surfaces and other areas. Aerodynamic efficiency of the aircraft is seriously affected if this accumulation of snow, ice and hoar-frost is not completely removed.

2 It is mandatory that all accumulations of snow, ice or hoar-frost, no matter how slight, on aircraft surfaces be completely removed before the aircraft is signed out as serviceable.

Purpose

3 The purpose of this Engineering Order is to provide a source of preventive measures to be observed while aircraft are subjected to cold weather operations and the action, cautions and approved solution necessary in the removal ofice, snow and hoar-frost from aircraft surfaces.

Prevention

Aircraft Surfaces

4 Covers in good condition are the best method of protection against snow, frost or ice accumulations. Approved aircraft covers for RCAF use are listed in CAP 10 Section 27D and are available on demand.

5 Caution should be exercised when using covers at tempertures exceeding -3.89 degrees C (25 degrees F) as rain or wet snow may freeze covers to surfaces. To prevent covers from freezing to surfaces, a film of anti-icing fluid should be applied first. A satisfactory procedure is to apply the anti-icing fluid to the surfaces after the last flight of the day and then apply covers. Frost and light snow which then form can easily be removed with minimum sticking of covers.

6 Covers are never installed over aircraft surfaces with frozen or freezeable moisture present. Wet covers are not to be used for covering aircraft surfaces but should be completely dry before applying. Care must also be exercised to ensure that covers are free from accumulations of oil, grease, hydraulic fluid etc., as these conditions create a fire hazard.

7 Covers when not in use should be completely dried and hung or stored in a dry place.

8 When approved covers are not available, an alternate method of protection is the use of a net made of $1\frac{1}{2}$" cotton webbing constructed with 3" square openings. This net should be draped over the sing and secured exercising the same precaustions as specified for approved covers. When net is removed, 90% of the snow is removed.

Canopies

9 Canopies and perspex surfaces should be covered to prevent snow and ice accumulation. Covers should be of the fitted type normally supplied with each type of aircraft.

Pitot Heaters

10 Pitot tube covers should be used at all times to ensure no drifting snow or freezing rain enters the pitot tube.

Removal

11 Removal of snow, ice and hoar-frost from aircraft metallic surfaces may be carried out by one of the following methods: -

(a) Defrost the aircraft in a heated hangar ensuring that all surfaces are completely dry before removing from hangar.

(b) Sweep the aircraft surfaces with a hand broom.

(c) Spray the metallic aircraft surfaces with isopropyl alcohol Ref 34A/214 Spec 3-GP-525: -

(i) Use defrosting fluids sparingly and ensure the mixture does not enter the engine(s) compartment.

(ii) Excessive use of alcohol mixture could result in flushing action of lubricants. Ensure all control surface bearings, actuator and/or screw jack moving parts that may be exposed to defrosting solution are adequately lubricated after each application of alochol mixture. Do not use methyl alcohol as a method of defrosting.

NOTE: If sufficient quantities of isopropyl alcohol Ref. 34A/214 Spec 3-GP-525 are not available, a suitable defrosting fluid may be obtained by mixing locally 80% ethylene glycol Ref 34A/172 Spec 3-GP-850, 20% isopropyl alcohol Ref 34A/214 Spec 3-GP-525 and approximately 10 fluid ounces of commercial destros per gallon of mixture.

CAUTION: Ensure this defrosting mixture is not used to top up carburetor and/or other anti-icing tanks.

Canopies

12 When it is necessary to defrost canopies or perspex surfaces the only recommended method is to apply heat using approved ground heating units. Ducts should not blow directly on perspex surfaces if the temperature of the surface will exceed 49 degrees C (120 degrees F) at any spot.

Propellers

13 Alcohol anti-icing systems will not remove ice already formed on propellers. Therefore, all ice deposits on propellers should be removed before starting engines. If icing temperatures exist, anti-icing systems should be operated immediately after engine starting.

Jet Blast

14 The use of jet blast from another aircraft as a means of defrosting will only be used in extreme emergency. If the jet blast method is used, the distance between the tail pipe and the nose of the aircraft being defrosted will be at least 38'. Personnel will ensure before using the jet blast as a defrosting method, that all debris in the proximity of the aircraft is removed because of the possibility of damage to the aircraft.

Critical Areas

15 Air inlets and vents should be thoroughly inspected for ice of snow accumulations. Static pressure source for flight instrument that are located flush with the skin of the fuselage are very susceptible to icing conditions. These are to be thoroughly inspected.

CAUTION: The use of sharp pointed objects, such as screwdrivers, scrapers, ice picks or items of a similar nature for the removal of snow or hoar-frost from aircraft surfaces is strictly forbidden.

MAINTENANCE OF QUICK RELEASE PRESSURE FASTENERS

General

1 Experience has shown that insufficient attention is paid to the care and maintenance of quick release pressure fasteners. Investigations have proven that aircraft accidents and incidents have been directly attributed to aircraft inspection panels and cowlings secured by these fasteners coming loose while airborne, resulting in damage to the aircraft, and creating a possible accident hazard to personnel.

Definition

2 Quick release pressure fasteners are used to secure engine cowlings, fairing, panels and similar sheet metal componentsrequiring repeated and rapid attachment and removal. The common types of quick release pressure fasteners are Dzus, Camloc, Airloc, Paneloc, Zahodiakin, Lion, Oddie, Simmons and Shakeproof. Installation and replacement instructions for these fasteners are contained in EO 05-1-3 Part 7.

Inspection and Repair

3 In order to ensure that fasteners are serviceable they are to be inspected before replacing panels etc., and if found defective the following action is to be taken.

DEFECT	REPAIR
Wire spring or pin distorted or broken	Replace broken riveting or replace pin as per EO 05-1-3 Part 7 Chap 28
Slots cracked, bent or broken dzus studs	Replace dzus stud as per EO 05-1-3 Part 7 Chap 11
Hole in plates or panels oversize or cracked	Repair by patching as per EO 05-1-3 Part 24 and replace stud.
Stud receptacles bent cracked or broken	Replace stud receptacle as per EO 05-1-3 Part 7 Chap 27
Stud cross pin not centralized	Centre or if distorted replace as per EO 05-1-3 Part 7 Chap 28
Rivets in receptacles or wires loose	Replace rivets if rivet holes in receptacles oversize, replace receptacle.
Slot in head of stud distorted	Replace stud
Safety marks removed	Repaint safety marks.

NOTE: Excessive pressure, pounding or hammering should not be applied in licking quick release pressure fasteners. If excessive pressure pounding or hammering is applied on pressure fasteners the spring, stud or receptacle will be damaged.

Safety Marks

4 Safety marks in the form of a stripe are to be painted across the head of the fasteners and on the metal adjacent to all quick release pressure fasteners to indicate the locked position of the fasteners. The colour is to be ivsually distinctive at all times. The colour of the stripes is to be governed by the colour of the cowl surrounding the fasteners as follows:

(a) Yellow stripes on black background.

(b) Black stripes on yellow background.

(c) White or red on camouflage background.

(d) For colour specifications refer to EO 05-1-2U.

Positive Locking Precautions

5 During maintenance of inspections, panels, cowls, etc., will be in one of two positions.

(a) Panels, cowls etc, are to be on the aircraft with all quick release pressure fasteners in the locked position.

(b) Panels are to be completely off the aircraft and placed on shelves, stands etc, or hanging on chains attached to the aircraft. This will ensure panels are not accidentally left partially installed when an aircraft becomes airborne.

WARNING: Ensure all quick release pressure fasteners are in positive locked position at all times when panels, cowls etc, are installed. The safety marks should be in proper alignment when fasteners are in the positive locked position.

AIRCRAFT FUEL TANKS - FUEL LOADS

1 The operation of aircraft with reduced fuel load to increase the pay load on schedueled flight is authorized. Passenger and feright sections are to adhere strictly to aircraft loading tables where pay load is increased in proportion to the reduced gasoline load.

2 Any bladder cells, self-sealing fuel cells, and integral ranks which embody a sealing compound in the seams and joints, which are likely to remain empty for an appreciable length of time due to reduced fuel loads, must be considered, as subsequent cracking and checking will result. Preferably these tanks should be sprayed internally with lubricating oil, Ref 34A-35, or alternately retain aminimum of one-quarter of the normal fuel capacity.

3 The above doesnot apply to aicraft used for training purposes. The fuel state of these aircraft is to be in compliance with existing instructions. At completion of day or night flying prior to storage in hangars or outside, fuel tanks are to be filled to safe capacity. Allowance is to be made for volumetric increase of the fuel due to temperature changes.

NOTE: Where aircraft are being ferried to contractors for repair or servicing, where practical, captains are to ensure that the amount of fuel carried is not greater than the minimum safe fuel load requirements for the intended flight.

AIR FILTER SCREENS AND GUARD REMOVAL

General

1 To eleminate possible engine power loss and/or failure, during winter months or when ever icing conditions may be encountered, carburetor and other air intake screens are to be serviced in accordance with this order.

Procedure

2 The following servicing instructions are to be followed: -

(a) Induction system air filters are to be removed form all aircraft so equipped.

NOTE: On removal of the filter screen on Harvard aircraft, it is important to check the rubber strip, Part B1208N20-8-16432, located in the carburetor cold air duct, to ensure that they are securely cemented to the mounting brackets for the cold air screen.

Air intake screen, Parts 393247, 605117 or D13948 are not be installed on Lancaster aircraft. The removal of the screen requires fitment of distance piece, Parts pp. 30308, 60564 or D16068 in lieu and are available at 5SD Moncton. Until distance piece is obtained, air intake screens are to have wire mesh removed and bare frame re-installed, where applicable

(a) Air intake screens are to be removed from air intakes whenever fitted.

(c) Carburetor deck screens, in addition to items in sub-paragraphs (a) and (b), are to be removed from aircraft that do not provide adequate carburetor heat to prevent icing of the deck screens. The carburetor air scoop is to be conspicuously marked with a one-inch red letter "X" when the deck screen is removed. On re-installation of the screen the "X" shall be removed or permanently covered until again required.

NOTE: The carburetor deck screen located between the intake duct and the carburetor should not be confused with the carburetor air filter that is installed in the induction system for the purpose of filtering dust, sand, etc, from the air.

(d) The following aircraft have adequate carburetor heat therefore, carburetor deck screens are to remain installed

Harvard	Neptune
Canso	Otter
C119 Packet	Helicopter H21
Dakota	Helicopter H5
Expeditor	Helicopter H19
Mitchell	Helicopter H34
North Star C-5	

Actions Taken in Other Than Winter Months When Icing Conditions May Exist

3 Snow and icing conditions may be encountered on certain air routes even during the summer months, e.g. North Atlantic route to the United Kindom. Action noted in paragraph 2 is to be taken when flying such routes. The decision to take such action will be the responsibility of the Chief Technical Officer or other engineering authority designated for airworthiness of the aircraft.

Replacing of Air Scoop

4 When the deck screens are removed, an exact replica of the frame of the screen is to be manufactured locally and installed so that the screws will not fracture the metal when they bottom in the tapped holes in the carburettor.

Action Taken When the Air Duct Attaching Screws are Fitted with Plain Nuts

5 In any installation designed in such a manner that the plain nuts and palnuts securing the carburetor intake duct are inside the air intake, the air duct attaching studs are to be drilled for safety and castellated nuts installed in place of the present palnuts.

Stowage of Screens and Filters

6 Stowage of screens and filters in aircraft is not recommended in training aircraft such as Harvard where aerobatics are constantly carried out. Stowage of filters and screens shall be left to the discretion of the Chief Technical Officer or other engineering authority so designated for airworthiness of the aircraft.

AIRCRAFT FINISH SCHEMES AND MARKINGS

General

1 The following finish schemes, indentifications and miscellaneous markings applied in accordance with Figure 1 of this Engineering Order, are to be incorporated on RCAF aircraft as applicable. The above work will be performed by Contractors, Repair Depots and Flying Units.

2 Standard aircraft finishes and identifications are to be applied as outlined in Figure 1 and illustrated in the latest issue of relevant RCAF Drawings.

Roundels

(a) The application of roundels can be accomplished by film activated adhesive or by painting using templates cut from drawings supplied. In no case are they to be hand painted directly on the aircraft.

Line Identification of Aircraft

(b) The last three numbers of the aircraft registration number may be applied on the front of the aircraft facilitate identification of aircra t when they are in line on the ground. This identification is to be black, four to eight inches in height, and is to be applied on the lower cowling of single engine aircraft or on the nose of twin or multi-enigne aircraft.

NOTE: For application instructions for markings aircraft, film, activated adhesive (CAP 10 Section 27H) refer to EO 05-1-3 Part 20, Paragraph 203).

3 The following special and emergency markings are to be standarized as described hereunder. Except when specified otherwise all markings and letterings are to be red, Spec. 1-GP-12A #9-2, in colour, except on yellow surfaces where the colour is to be black.

Size of Markings and Letterings

(a) Identification marking bands for emergency break in panel etc, are to be applied as wide as possible, but not to exceed two inches and in no case to be less than one inch in width. Letterings for entrance markings are to be preferable one inch high and in no event less that one half inch in height.

Normal Entrances Markings

(b) All crew and passenger entrances are to be marked "ENTRANCE" handles are to be painted and operating instructions, for example "TURN TO OPEN", are to appear nearby. An arrow shall indicate which direction the handle is to be turned or otherwise operated.

Emergency Entrances (Break in Panels)

(c) The area where an entrance may be effected in the event of a main entrance door jamming is to be marked with a broken band. Each segment of the broken band is to be approximately one inch in length with segments approximately twelve inches apart. Fabric and perspex is to be marked "BREAK HERE". Metal surfaces requiring an axe are to be marked "CUT HERE FOR EMERGENCY RESCUE".

Normal Exit Doors (Internally Operated)

(d) An identification marking band is to be applied to mark the complete periphery of normal exit doors, internal only. Such doors are to bear instructions for opening or jettisoning. There are to be no external markings for these exits unless they can also be used as normal entrances, see sub-para (b).

Exit Hatches

(e) Hatches which can be opened from the inside only are to be marked inside with the word "EXIT". An identification marking band is to be applied to mark the complete periphery of such exits where possible or practicable. Where an exit hatch can be broken into from outside or widened sufficiently to form an opening through which trapped occupants can be rescued, it is to be marked externally by a broken band.

Emergency Exits (Internally Operated)

(f) Emergency exits normally used for escape from inside out suitable for affecting a rescue from outside an aircraft, are to be marked with a broken band which will indicate the most suitable line along which to cut the boundary of the area to be broken through. The position of internal release handles is to be marked on the outside as it will usually be possible to reach and operate the handle after cutting a hole nearby. The words "CUT HERE", for emergency rescue are to be applied or stencilled in this area. Internally such exits are to be marked "EMERGENCY EXIT" and are to bear instructions for operating.

Turrets

(g) For and aft turrets are to bear instructions for breaking the perspex at that point which gives access to the release handle inside, to enable the turret to be turned and the gunner rescued through the door at the rear. A broken band or lettering is to mark the panel to be broken.

External Release of Pilots Cockpit Hoods

(h) On those aircraft where the cockpit hood can be released from the outside the hood is to be bounded by a broken band and operating instructions are to appear nearby.

Operating Instructions

(j) Suitably descriptive sketches, arrows etc, and instructions which are readily visible, are to be marked on the door or structure of the aircraft as near as possible to the relevant emergency release or handle tc identify and explain its operation. The wording is to be standard English such as "PULL", "PUSH", "TURN" or "SLIDE". Aircraft not having external hood release mechanisms on both sides are to have clearly marked on the non-release side "COCKPIT HOOD RELEASE ON OPPOSTIE SIDE".

(k) Cargo compartments of transport aircraft shall be marked with the compartment limits and the structural capacity in pounds.

Luminous Markers

(m) Except for those emergency exits located near the pilot's cockpit, a protected luminescent marker or markers is to be permanently affixed in the escape panel release handle, or is to be permanently placed as near as practicable to the escape panel release handle and in the same attitude so that in reaching the marker or markers, the escape panel release handle will be encountered. The size of the luminescent marker or markers for identification of escape panel handles, except for those emergency exits located in the pilot's cockpit is to be three inches long by one quarter inch wide.

Guide Notices

(n) To indicate mid-upper turrets, astrodomes and other entrances or exits which it is difficult or impossible to see from the ground, an arrow is to point to the position of rescue. A suitable notice is to be placed near the tail of the arrow. For example "EMERGENCY EXIT", "EMERGENCY ENTRANCE", "EXIT", "ENTRANCE EMERGENCY RESCUE", "BREAK IN TO DOME EMERGENCY RESCUE", "BREAK IN TO TURRET" Etc, as appropriate. A notice "ENTRANCE OTHER SIDE" or "EXIT OTHER SIDE" as applicable is to be painted on the side opposite a main entrance or exit.

First Aid Kit

(p) "The position of the first aid kit is to be indicated on the inside of the aircraft by the words "FIRST AID HERE" or if located in other compartment of the aircraft the position is to be indicated on the bulkhead or the bulkhead door with these words "FIRST AID INSIDE HERE".

Storage of Axe and Fire Extinguisher

(q) The position of the axe and the fire extinguisher is to be indicated on the inside of the aircraft by the words "AXE STOWED HERE" or "FIRE EXTINGUISHER HERE" or if located in another compartment of the aircraft the position is to be indicated on the bulkhead or the bulkhead doors with these words "AXE STOWED INSIDE HERE" or "FIRE EXTINGUSHERS INSIDE HERE".

NOTE

When axe or fire extinguisher can be reached from outside the aircraft by access through a door, window or panel, the exact position of axe or fire extinguisher is to be indicated on the outside of the words "AXE STOWED HERE" or "FIRE EXTINGUISHER HERE".

4 In addition to the above markings the following are to be applied to all aircraft, as applicable:

Marking of Basic Weight

(a) The basic weight, the weight of an aircraft ready to perform its role but less curew, fuel, oil , and operational load, is to be stencilled in one inch letters on the side of the fuselage beside the entrance used by the captain. Manufacturers are to mark the basic weight on aircraft before delivery. Overhaul contractors and repair depots are to mark or amend this weight as necessary after completing work on the aircraft. Units are also to amend this marking after incorporation of a modification that affects it. Commands are to ensure that action is taken to cover any aircraft which are not already marked.

Marking of Handling Points

(b) The marking of handling points is as follows:

(i) The points on the aft portion of the fuselage where the tail of the aircraft may be lifted without damaging the skin or the internal structure, are to be marked in black with the words "LIFT HERE" in letters two inches high for aircraft of basic weight greater than 2000 lbs, and one inch for aircraft of basic weight less than 2000 lbs. Arrows are to be included pointing to the actucal places or fittings where the lift is to be applied.

(ii) The jacking points are to be marked in a manner similar to that described in sub-sub-paragraph (i) above, except on specific authority from AFHQ.

(iii) Large aircraft components that require to be supported at particular points during assembly or dismantling and in storage are to be marked. Handling points, jacking points, or cradle positions as applicable come within this requirement; marks are to be sufficiently clear to remove all reasonable likelihood of damage.

Marking of Fuel Octane Numbers and Grounding Notice

(c) Markings to be done as follows:

(i) Aircraft powered by reciprocating engines are to be clearly marked in the vicinity of the fuel tank filler cap with the following words in half inch black letters: -

FUEL FILLER ,100/130,
F-18, CONNECT GROUND WIRE
BEFORE REMOVING FILLER CAP

or

FUEL FILLER, 80/87,
F-12, CONNECT GROUND WIRE
BEFORE REMOVING FILLER CAP

or

FUEL FILLER, 115/145,
F22, CONNECT GROUND WIRE
BEFORE REMOVING FILLER CAP

(ii) Aircraft powered by turbine engines are to be marked as above with the applicable specification as follows:

FUEL FILLER, , 3-GP-23, F-34

or

FUEL FILLER, , 3-GP-22, F-40

Marking of Bayonet Type Filler Caps

(d) All bayonet type filler caps on any aircraft tanks are to be marked to indicate their locked position. The marking is to consist of a narrow band across the top of the cap and an arrow on the adjacent structure with its point on the filler cap. When the cap is in the closed position, the shaft of the arrow is to be a continuation of the centre line of the band, both markings are to be of red or, in the case of red being the colour of the cap or surrounding structure, the markings are to be in black.

Marking of Pressure Fasteners

(e) Safety marks are to be applied in the form of lines of paint applied across the head of pressure fasteners continuing on the skin of the fuselage or components when the pressure fasteners are in the locked position. The paint will be a colour that will give a distinct contrast to the basic metal or painted surface. Black (1-GP-12A 10-1) will be applied to natural aluminum surface and white (1-GP-12A 10-2) or red (1-GP-12A 9-2) supplied to camouflaged painted surfaces.

(f) In order that the crew may have an indication of the relative importance of holes through the hull plating from any cause, the water line of boat seaplanes in the fully loaded condition is to be indicated on the inside of boat seaplane hulls by a half inch wide band of red marked on the frames or other suitable flat surfaces of the structure, unless already indicated by some other method. The accuracy of this indication need not be very exact provided that the line marked is well on the safe side. In hulls which have a permanent floor above the water line, the following notice is to be applied on the side near the floor: "THIS PORTION OF THE FLOOR IS ABOVE THE WATER LINE".

Marking of Propeller Zone for Training Aircraft

(g) To indicate the danger zone of the propeller on twin engine training aircraft, vertical red stripes are to be applied on the sides of the fuselage and on the leading edge of the wing.

Search Markings of Aircraft

(h) The top and bottom surfaces of the outer third of each wing and the top and bottom surfaces of the tailplane are to be applied bright red, Spec 1-GP-12A #9-2, in accordance with appropriate RCAF Drawings listed in Figure 1. Search markings are to be applied at the discretion of Commands.

Marking of Target Towing Aircraft

(j) Aircraft designated for target towing in Canada are to be distinctively marked in fluorescent fire orange ((33A/524) paint according to the appropriate drawing as shown in Figure 1, regardless of type of towing equipment fitted in aircraft.

Marking of Search and Rescue Aircraft

(k) Primary aircraft designated for search and rescue operations will be painted with a ring of fire orange (33A/524) with a blue border (1-GP-12A 2-6) on the rear fuselage. The word "RESCUE" applied in fire orange (33A/524) on the sides of the fuselage in 24 inch letters. Aircraft are to be painted as illustrated in applicable aircraft drawings as fhown in Figure 1.

NOTE Fluorescent paints. For application instructions for sun-bounded Day Glo" 33A/524) fluorescent paint see RCAF Drawing 14946.

Additional Markings

The following special markings are to be applied only as designed by AFHQ:

(a) Ambulance aircraft which are to carry the "Geneva" red cross on a white disc of the same diameter as the outer ring of the roundels.

(b) Harvard armament trainers are to have a black checkered design applied on the rudder, and the extreme wing tip is also to be painted black as illustrated in RCAF drawing 42404.

Squadron Badges

6 Squadron Badges which have been approved by AFHQ may be carried if desired on aircraft, but, they must be removable at short notice without leaving any trace. The badges shall be centrally positioned on the port side of the nose.

Nato Aircraft (Overseas)

7 Aircraft on Nato operations will have the Canadian Red Ensign applied on the vertical stabilizer in lieu of the fin flash. Ensign will be applied as per specifications shown on RCAF Drawing 5069.

GROUND TO EARTH CONDUCTIVITY FOR RCAF AIRCRAFT

Purpose

1 Aircraft stored in hangars and aircraft undergoing maintenance operations have a tendency to accumulate an electrostatic charge which presents potential fire hazard. This charge, therefore, is to be brought to ground.

General

2 Grounding is to be accomplished by means of a connection from some metal part of the aircraft to an approved grounding point when: -

(a) Aircraft are hangared.

(b) Electrical facilities or equipment is used, ie, electrical extensions, electric drills, testing of electrical components, etc.

(c) Maintenance work is contemplated and jacking up of the aircraft is necessary.

(d) Polishing, buffing or rubbing down.

3 For grounding instructions during refuelling or defuelling aircraft refer to EO 00-80-4/6.

4 Units are to ensure that the following is accomplished:

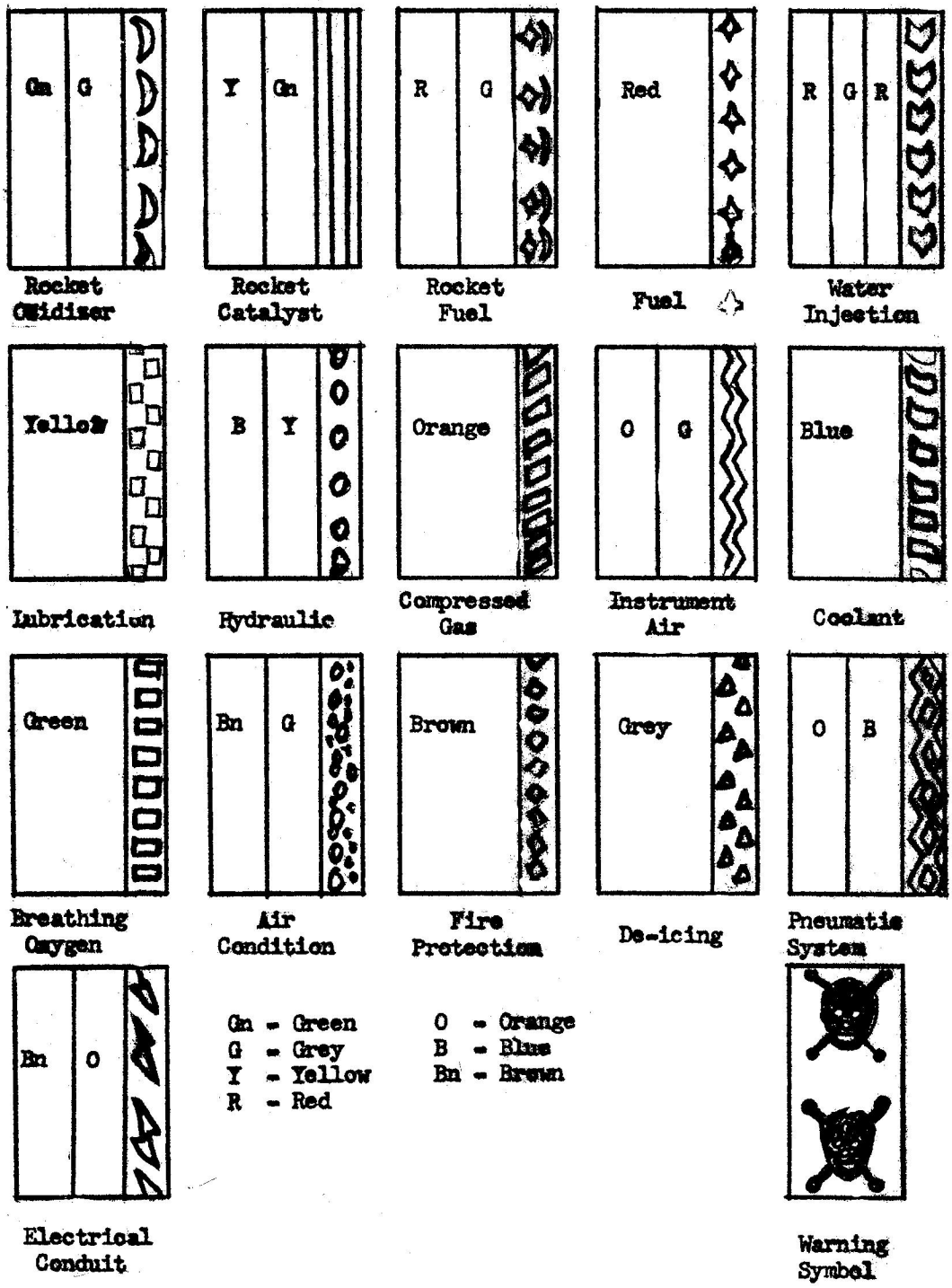
(a) Grounding chains or springs on aircraft which ensure ground to earth when the aircraft is in normal taxiing position are kept in a serviceable state.

(b) Aircraft high tension grounding cables are complete with alligator clamp on each end.

PIPE LINE IDENTIFICATION

General

1 To avoid confusion by maintenance personnel in the identification of pipe line in aircraft and ease the tracing of Pipe Line systems, the following symbols and colour codes are to be used on all RCAF aircraft.



Gn - Green
G - Grey
Y - Yellow
R - Red

O - Orange
B - Blue
Bn - Brown

2 The colour codes represent designations for systems only. For coding lines which do not fall nto one of these systems, the contents shall be designated by black lettering on a white tape.

3 The Geometrical symbols shall be in outline only in bands approximately 3/16 inch wide and confined to the right hand side of the tape within $\frac{1}{4}$ inch from the edge. The symbols shall be spaced approximately as shown above. Lettering and symbols shall be printed in black.

4 The main function of the line shall be printed on the tape as shown in illustration. The lettering shall be 3/32 inch high minimum and each line repeated at intervals not exceeding the diamter of the tube on which it is to be used.

5 Subsidiary functions or identification of line content may be indicated by the use of additional words or abbreviations which shall be carried on a second tape adjacent to the first or alternatively, interposed between the words descriptive of the main function.

6 Colours used on these tapes shall conform to ANA Bulletin No 166 or CGSB-IGP-12A.

RCAF Colour Code CGSB 1-OP-12A		Colour	ANA 166 Code No.
Light Blue	-2-6	Light Blue	501
Light Green	-3-7	Light Green	503
Light Yellow	-5-1	Light Yellow	505
International Orange	-8-2	International Orange	508
Insignia Red	-9-3	Insignia Red	509
Brown	-4-4	Maroon	510
Aircraft Grey	-1-6	Aircraft Grey	512
Black	-10-1	Black	514

7 Part numbers required by Aircraft Contractors shall not appear on these tapes but may be applied on a separate white tape.

8 Tapes except the warning tape to be one inch minimum width. The warning tape to be 3/8 inch wide.

9 Warning symbol tapes shall be applied to those lines whose contents are considered to be dangerous to maintenance personnel. Warning tapes to be placed adjacent to system identification tapes.

10 One band shall be located on each tube segment, twenty-four inches or shorter, provided that both ends of the segment are within the same compartment. One band shall be located at each end of each tube segment longer that twenty-four inches were the tube segment passes through more than one compartment or bulkhead, additional bands shall be applied so that at least one band is visible in each compartment, or on each side of the bulkhead.

11 Pressure transmitter lines shall be identified by the same colours as the lines from which the pressure is being transmitted.

12 Filler lines, vent lines and drain lines from functions or related functional equipment specified hereon shall be identified by the same colours as the function lines.

13 Telecommunication and armament system wave-quides are to be classified as pipe lines and are to be identified in accordance with para (2) sentence 2 using the single word "Wave-Guide".

14 Tapes shall not be used on Pipe Lines in the engine compartment where there is a possibility of the tape being drawn into the engine intake. For such locations, suitable paints conforming to this colour code, and which have no deleterious effect on the material used for the lines, shall be used for identification purposes. In these cases, the Geometrical symbols may be ommited.

15 No changes are to be made in colour code or symbols in this Engineering Order without prior consideration by Tripartite Authorities through the RCAF A.S.C.C. Member.

16 This EO conforms to AND 10375, latest issue.

INSTALLATION OF SEALS RINGS, GLANDS AND PACKING

Foreward

The term seals as applicable to aircraft, aircraft engines and their accessories will cover "O" rings, glands and packings used on alcohol, fuel, hydraulic, oil and pneumatic systems and accessories.

General

1 When installing seals the general procedures contained herein are to be followed to ensure satisfactory service. Where detailed direction is required to carry out a specific installation in any component involving seals, reference is to be made to the applicable AFEO -2 or -3 of the component concerned and if necessary to approved applicable manufacturers' overhaul instructions.

Procedure

2 For all installations of seals the following general procedures are to be observed.

(a) Ensure that correct type of seal is used for the fluid and system.

(b) Visually inspect seal for imperfections, unusual hardness or softness, nicks or cracks.

(c) Refer to AFEO 00-35-1 for age control and cure date information.

NOTE: If any doubt exists as to identification of material, immerse the seal for at least 10 hours in the fluid in which it is to operate. If the swelling exceeds 3% of the original size of if the seal becomes soft and flabby the seal is to be rejected.

(d) Ensure that the surface of the shaft on which the seal operates is smooth and free of burrs, nicks or scratches, which may damage the sealing lip, a small scratch may result in costly leakage.

(e) If the seal is to be installed over a square end, threaded, splined or keyed portion of a shaft, the seal is to be protected by a suitable well lubricated mounting thimble, see Figures 1, 2 and 3. In an emergency and if no other means is available an alternate method is to wrap the shaft with heavy well lubricated draft paper.

(f) Where possible the installation is to be checked by hand for freedom of movement prior to testing of the complete system.

(g) For static and reciprocating pneumatic seal installations grease MIL-L-4343A is to be used as a lubricant.

(h) The seal, shaft etc., is to be lubricated with the fluid in which the system operates.

Metal Enclosed Seal Installation

3 When installing a metal enclosed seal it is imperative that a proper size installation tool be used to localize the pressure on the face of the metal case as closely as possible to the outside diameter. The installation tool to be not more than .010" smaller than the diameter of the bore and is to have a flat contact surface. The tool is to be placed squarely in position and tapped on the end with a mallet.

NOTE: Avoid direct hammer blows on the face of the seal.

4 See Figures 1 and 2 for various installations. If the tool is to be used as in Figure 1 the inside diameter is to be not less than .020" larger than the outside of the mounting thimble.

V-Ring Packing Installation

5 V-ring packing installations are to be adequately lubricated with the system fluid and installed with the sealing lips adjacent to the fluid, making certain that the packing ring is properly seated by tapping lightly with a suitable blunt rod or similar tool. DO NOT USE A SCREWDRIVER OR OTHER SHARP TOOL. When sets of packing rings are installed each ring must be installed individually.

6 When installing V-ring glands in a hydraulic component with an adjustable gland nut, tighten the gland nut until the V-ring stack is compressed firmly together then loosen the gland nut to the first locking point (not to exceed one sixth of a turn). Occasionally when a set of strut glands have been installed in a heated hangar and aircraft later moved outside into low temperature, slight shrinkage of packing takes place with the result that leakage often develops. As a preventative measure, the aircraft after removal from a warm hangar, could be left outside for approximately thirty minutes then taxied a short distance to settle the new glands. The aircraft should then be jacked up outside, air pressure released from the struts and the gland nut readjusted in accordance with instructions herein.

7 V-ring glands installed in hydraulic components and held in compression by the gland nut will take on a permanent set over an extended storage period. To minimize this condition after renewal

of glands and prior to delivery of storage, back off the gland nut sufficiently to relieve any compression, yet leave sufficiently tight to retain the glands in their proper location. A tag indicating that re-adjustment is required prior to test or installation is to be attached to the component.

8 If no adjustable gland nut is used, metal shims of graduated thicknesses will be inserted behind the adaptors of the packing glands in such a manner that the glands will be held firmly in place. To ficilitate the installation of shims they may be split and the open end brought together after insertion in the gland. Staggering of open ends is preferable.

"O" Ring Installation

9 "O" Rings generally require no adjustment after installation. However, care must be taken when installing new "O" rings that they do not twist or nick, or early failure will result. After installation check to make sure that the "O" ring is of the proper size to give a "squeeze" in the installed position, See Figure 4. "O" rings may be removed easily by use of a small tool made of duralumin or brass rod, see Figure 5. Care is to be taken not to scratch or mar the groove or corners.