Lockheed

VOL. 13, NO. 4, OCTOBER—DECEMBER 1986

service news

A SERVICE PUBLICATION OF LOCKHEED-GEORGIA COMPANY, A DIVISION OF LOCKHEED CORPORATION

Engine Compressor Washing

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Vol. 13, No. 4, October-December 1986

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Cover: Ski-equipped **U.S. Navy C-130s form a vital link in the supply lines supporting Antarctic scientiiic research. This year, the U.S. Navy celebrates the 75th anniversary of naval aviation.**

Focal Point

Supportability Comes of Age

We at Lockheed-Georgia have long recognized thecentral importance of high reliability and ease of maintenance in our products. Over 30 years ago, when the C-130 Hercules aircraft program was just beginning, formal reliability and maintainability departments were established for the purpose ofensuring that these characteristics received full consideration during every step of the design process.

All airframe manufacturers are faced with the necessity of reconciling a wide variety of factors in building a successful aircraft. In the quest to achieve an overall optimum design, reliability and maintalnability have historically been subject to the same sorts oftrade-offs asotherdesign characteristicssuch as weight, range, and speed. The final configuration has always been biased towardthose performance characterlstics which our customers deemed tobeparamount. In other words, we have always tried to give each of our customers exactly what he needed.

We still bend every effort to give our customers what they need. and today this involves a significantlygreateremphasison reliabilityand maintainability. This message has become particularly clear in the case of the U.S. Air Force, which now ranks reliability and maintainability above initial cost, schedule, and performance in evaluating proposals for new aircraft.

An important consequence of this change in customer requirements is that reliability and maintainability considerations at Lockheed-Georgia have now become coequal with **more** traditional constraints in the design process.

Such coequality is reflected in a recent reorganization within our Engineering Branch. In early 1986, the **position** of Chief Engineer-Supportability was created. This position is at the same organizational level as our Chief Engineer-Design,ChiefEngineer~Research and Technology. and Chief Engineer-Electronics and Test, all of whom report directly to our Vice President-Engineering.

Concurrent with this reorganization, we instituted:

- A strengthened and more focused supportability research and development program, directed toward advancingthe state of the art in reliability and maintainability design.
- A supportability computerization plan to establish a rapid, effective, computerized interface among design, logistics, and management organizations.
- A pro-active role for reliability and maintainability in the overall design process. which includes production drawing sign-off authority.

The goal of our new reliability and maintalnability posture is ambitious but clear: to provide our customers with aircraft which are twice as reliable, but require half the maintenance effort.

Sincerely,

Hunter Sohn

H.M. **Sohn, Manager**
Supportability
Engineering Division

PRODUCT SUPPORT LOCKHEED-GEORGIA COMPANY MARIETTA, GEORGIA 30063

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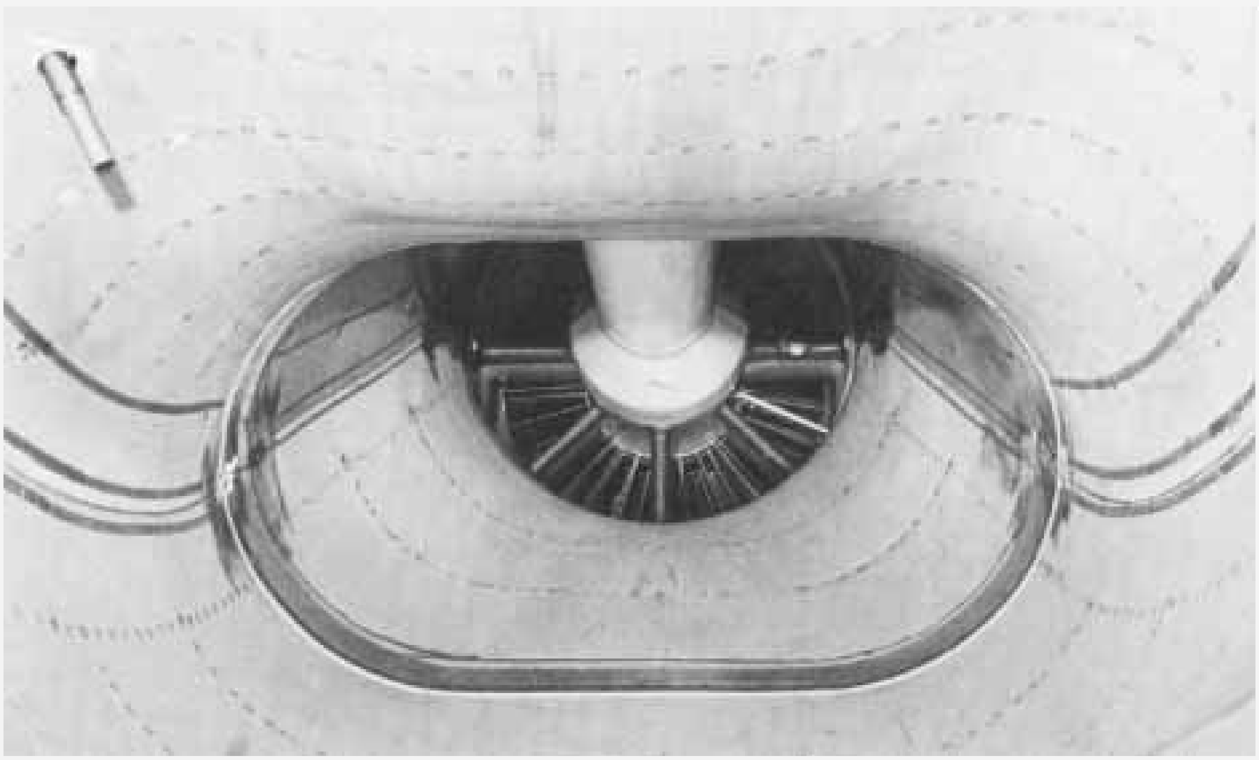
ENGINE COMPRESSOR CLEANING



OPERATING IN SALTY ENVIRONMENTS

After flying in the salty environments found near oceans or seashores or in areas of heavy airborne industrial waste, operators may find that their T56/501 engines are losing power prematurely. This deterioration of performance, indicated by higher than normal TIT for a given torque, may be caused by a build-up of foreign material on the compressor blades. With many hours of continued use under these conditions, build-up can increase to the point where it will significantly disturb the flow of air across the compressor rotor blades and stator vanes, resulting in reduced compressor output for a given rpm.

Routine liquid cleaning or water wash of the compressor will normally remove these deposits and restore compressor efficiency. It should always be kept in mind, however, that power losses cannot arbitrarily be attributed to a dirty compressor; all such cases must be fully investigated.

Field Cleaning

T.O. 2J-T56-101 and the applicable Allison maintenance manual describe methods of field cleaning the engine compressor stator vanes and rotor blaces by use of water or chemical solution liquid cleaning, or, for tough jobs, abrasive cleaning (using ground walnut hulls or apricot pits, for example).

The procedure recommended in cases where compressor contamination is suspected or confirmed by visual inspection, is first to liquid clean the compressor, then to do a performance check. If the performance check reveals continued reduction in engine compressor output, the abrasive cleaning procedure should be considered.

Frequency

Aircraft operated in a sea air environment require more frequent applications to remove the corrosive deposits from the internal surfaces of the compressor section. Note that the salt water mist or spray along a coastline decreases rapidly in the first half mile from the shoreline and at altitudes over 500 feet. Of course the rate of this reduction will vary according to climate, wind direction, and velocity. For this reason, aircraft operated anywhere in the vicinity of a coastline should have corrosion preventive washes of the compressor section as detailed below.

Ingested Salt Water

An engine that has salt water introduced directly into the compressor as a result of direct wave splash or operation near a seashore where there is wind pickup of salt water mist or spray should have a compressor water wash performed after the last flight of the day.

No **Direct** Exposure

Engines on aircraft located near sea air environments but not directly exposed to sea air, in other words not within one-half mile of the coastline or less than 500 feet above the water during flight or ground operations, should undergo air compressor liquid cleaning at least every 15 days unless inspection reveals the need for more frequent applications.

Inactive Engines

If an engine is to be inactive for more than a few days after operation in a salty environment, the compressor should be liquid cleaned after the last flight prior to the period of inactivity. After it is cleaned, the engine may be considered relatively safe from the corrosive effects of the salty environment for about two weeks. After this time, it will be necessary to inspect the compressor to determine if there is evidence of corrosive deposits. If such deposits are found, the compressor should have an additional liquid cleaning whether the engine is to be returned to service immediately or only after continued inactivity.

If an engine in a sea air environment has not been operated for a period of three days or more, the compressor should be liquid cleaned before the engine is returned to normal operation.

Note that T.O. 2J-T56-101 contains procedural instructions for compressor liquid cleaning for removal of oil and other deposits which adhere to blade and vane surfaces and reduce compressor efficiency. Aircraft not equipped with the overboard drain for the propeller scupper will require more frequent cleaning due to propeller oil leakage into the inlet duct.

Corrosion Control

Constant vigilance and strict adherence to proper cleaning procedures must be maintained in order to prevent corrosion deposits from forming inside the compressor section of the engine.

When an aircraft is to be idle for a period of time, all engine orifices (intake and exhaust openings, etc.) should be closed using the appropriate covers or plugs according to established procedures.

An engine which has been inactive and has accumulated internal moisture as a result of rain leakage or condensation should be run as soon as possible until it is dried out.

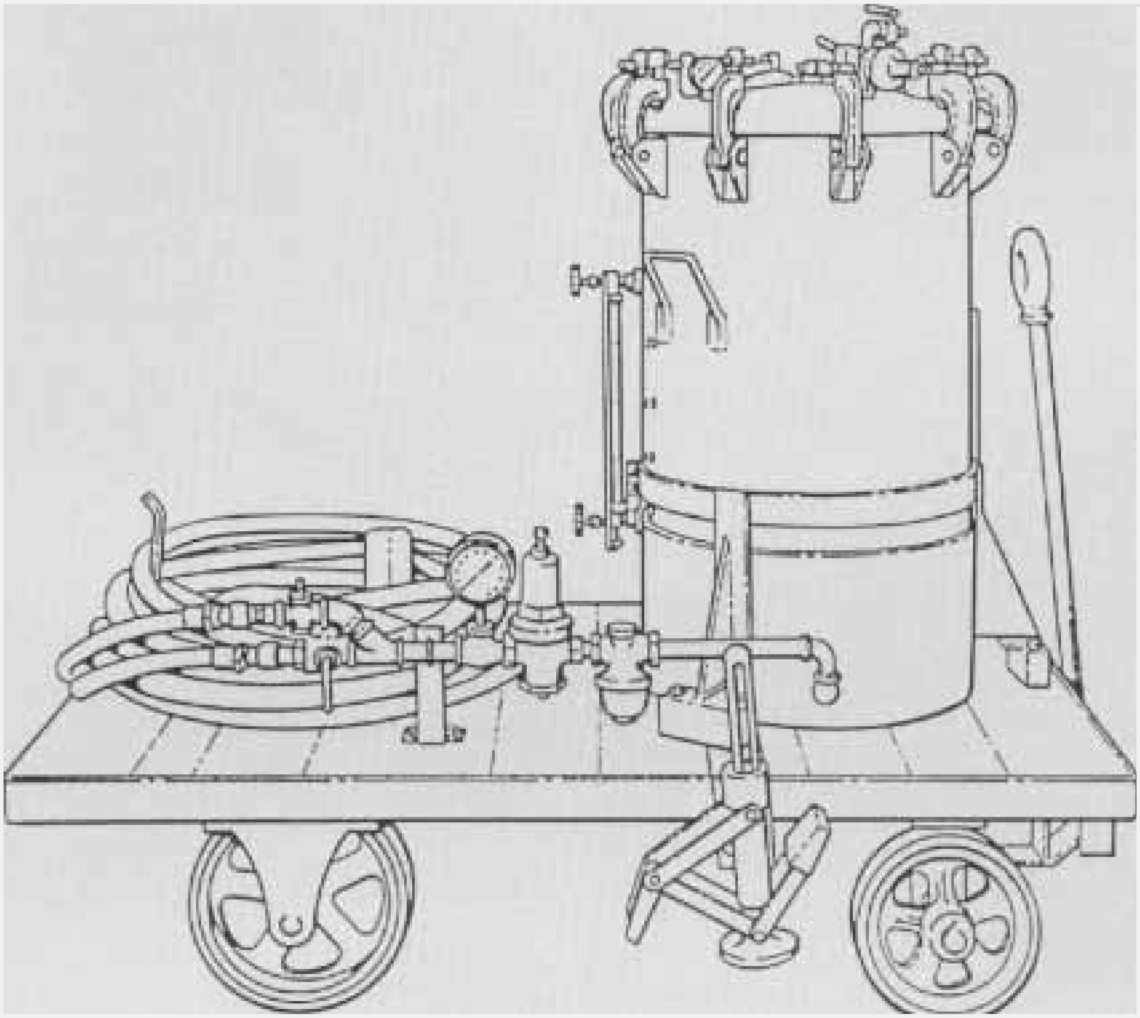
EQUIPMENT AND MATERIALS

It is important to utilize proper equipment and materials when performing compressor liquid cleaning operations. Failure to do so may result in a further reduction in compressor efficiency or damage to the compressor.

The specific type of equipment is not as important as equipment capabilities. The equipment must deliver the water or chemical solution to the engine inlet with a flow rate capability of 10 gallons per minute. In addition, there is a need for a dry air supply at a minimum of 50 psig to hold the compressor bleed valves closed during water wash application.

The following equipment is listed in SMP 515E:

- **Cleaning and Preservation Unit,** PN LTCT 23980-01, manufactured by AVCO-Lycoming.
- Jet **Aircraft Engine Corrosion Control Spraying Unit,** PN 76E04000-30A, manufactured by Metric Systems Corporation.



Part No. 6796852
Compressor Salt Deposit Spray Cleaning Pressurized Tank

The following equipment is listed in the Allison manuals:

- **Corrosion Control Water Wash Trailer,** PN 6796852/ MIL-S-83189A (FSN 1730-00-403-3028), available from Allison. Provides cleaning agent under pressure.
- **Model 299 Spray Mix Applicator,** manufactured by B and B Chemical Company.

Many operators, however, have devised their own version of the required equipment, customized to suit their specific needs.

Noncorrosive, Nonflammable Cleaners

The recommended chemicals and mixtures for liquid cleaning of the engine compressor are as follows:

- **B and B 3100, FSN 6X50-00-282-7597** for 55 gallons/FSN 6850-00-181-7594 for 5 gallons, B and B Chemicals Company, Inc., P.O. Box 796, Miami, Florida 33166. Mix at a ratio of one part chemical to four parts water.
- **Penetone 19,** Penetone Corporation, 74 Hudson Avenue, Tenafly, New Jersey 07670. Mix in a ratio of from one part chemical to four parts water to full strength, depending on the degree of engine contamination.

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- Turco 4217, 5884, and 5884-AG, Turco Products, 24600 South Main Street, Carson, California 90749. Mix in a ratio of one part chemical to four parts water.

Water Supply

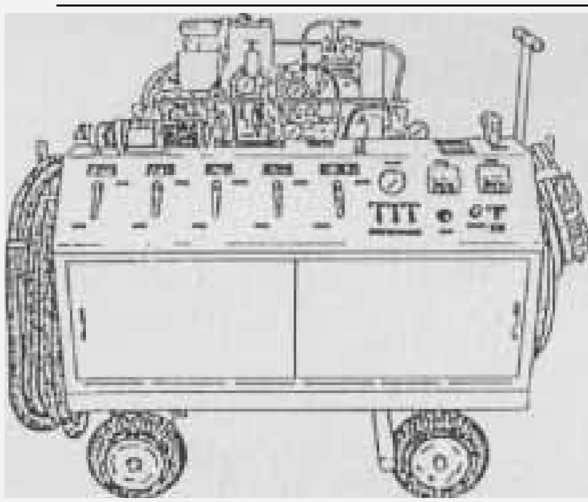
Water suitable for washing the **engine** compressor must be of drinkable quality. It must be of sufficient pressure and volume to provide a flow rate of 10 gallons per minute.

The chemical purity of the water is also important. Most bottled "mineral" water found in stores has around 500 parts per million total dissolved solids. Water with greater than 472 parts per million total dissolved solids can eventually degrade engine performance. Furthermore, water with a chloride content of greater than 20 parts per million can cause corrosion in the engine structure and should not be used.

Scale Build-Up

Studies have shown that as the water passes through the compressor section during the liquid cleaning and rinse procedure, the dissolved solids in the water are separated from the water as it is vaporized. As minute airborne particles these solids are then deposited on the compressor blades. Such deposit results in a build-up or "scale" that is similar in appearance to the precipitate found in the bottom of a tea kettle after hard water has been boiled in it.

This scale can change the aerodynamic characteristics of the blades, resulting in increased drag, turbulent



Part No. LTCT 23980-01
Cleaning and Preservation Unit
Manufactured by AVCO-Lycoming

airflow, or perhaps even cavitation (compressor stall) --just like the salt deposits that are the reason for the compressor wash in the first place.

There are two factors that determine the rate at which a particular engine will have scale build-up in its compressor section: the amount of wash water containing dissolved solids that is used in cleaning the compressor, and how long the engine has operated.

The degree of scale build-up tends to be directly proportional to the amount of water ingested by the engine during the cleaning process. For this reason it is important to be aware of the quantity of water called for in the compressor liquid cleaning instructions found in the Allison maintenance manual or in T.O. IC-l30H-2-4, Section Il.

The scale wears away or flakes off during engine operation. The longer the engine is operated, the less the scale build-up. The scale will accumulate only until a dynamic balance is established between the build-up incurred during water rinse and the wearing away during engine operation. To remove the scale from the compressor requires an abrasive cleaning procedure as specified in the Allison manual or in T.O. IC-130-2-4, Section 11-41.

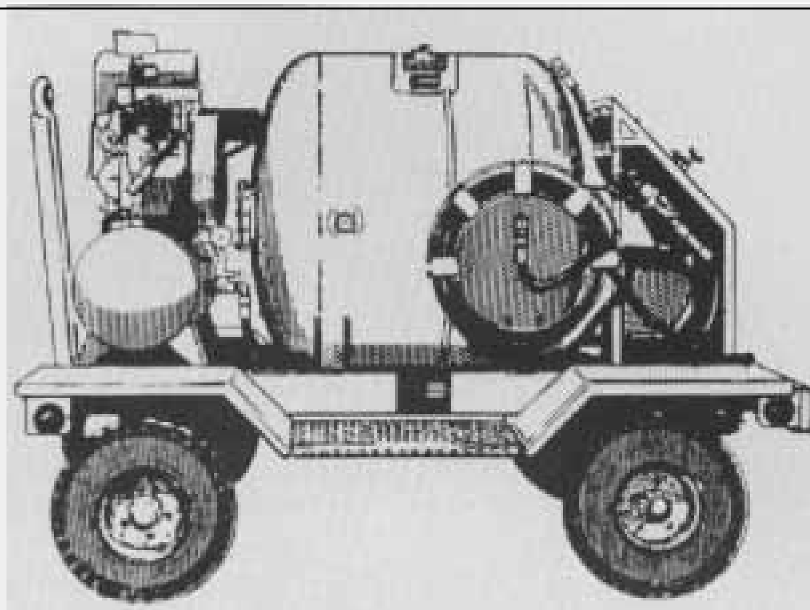
CLEANING PROCEDURES

The instructions in the applicable maintenance manual should be carefully followed when performing compressor water wash operations.

While motoring an engine by the starter during the cleaning procedure, remember that the starter presents the same safety hazard as an engine that is running. Be sure to take appropriate safety precautions. Also, bc aware of the starter duty cycle: the procedure in the Allison maintenance manual recommends that the engine be motored to maximum available starter rpm for approximately 30 seconds. (Note that the procedure in T.O. lC-130H-1 specifies a maximum cycle of 1 minute starter ON followed by 1 minute OFF.) The starter should not be operated longer than 60 seconds at a time.

Ensure that the condition lever for the engine is in the GROUND STOP position so that the ignition system will bc deactivated during engine motoring.

Always allow the engine to cool for at least 4.5 minutes after shutdown before performing the water wash or chemical cleaning procedure. Note that if the



Part No. 76E04000-30A
Jet Aircraft Engine Corrosion Control Spraying Unit
Manufactured by Metric Systems Corporation

chemical solution is injected into the engine while the engine is too hot, the solution may congeal on the blades, vanes, and valves, requiring a repetition of the cleaning and rinse cycle. Also note that the flash point for some of the chemical cleaning agents may be as low as 150 degrees F (66 degrees C) in concentrated form.

Salts and other corrosive, water-soluble deposits should be removed from the engine inlet duct, air inlet housing struts, and bands of the inlet guide vanes by flushing with a fine spray of fresh water. Approximately 10 gallons of the spray per engine should be a sufficient quantity of water for accomplishing this.

About 50 psi of compressed air from an external dry air source (air bottle or portable air compressor) is required to hold the 5th-and 10th~stage bleed air valves closed during the cleaning procedure. Be sure to cap the outlet fitting of the speed-sensitive valve assembly when the air hose is disconnected. Install an appropriate uncontaminated union in the hose so that the compressed air source may be plumbed in at that point.

Always rinse the compressor thoroughly with water after a chemical cleaning has been done. While repeating the engine motoring sequence, rinse until the water coming out the tailpipe is clean.

If the engine performance remains at an unsatisfactory level after the liquid cleaning process has been accomplished, perform a thorough visual inspection for compressor erosion through the compressor bleed valve ports. Should the inspection reveal an eroded compressor, do not perform abrasive cleaning: abrasive cleaning of an eroded compressor may further reduce the performance of the engine. If, however, the inspection reveals no compressor erosion, then perform the abrasive cleaning procedure as described in the Allison maintenance manual or in Section 11 of T.O. lC-130H-2-4.

Be sure that the engine has been restored to its normal configuration prior to drying out and additional performance checks.

Periodic liquid cleaning of the engine compressor is an important consideration in every maintenance program. Such maintenance will prevent unnecessary deterioration of engine performance that can result from compressor contamination.

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IS THERE WATER IN YOUR DORSAL?

Hercules dorsal fin has a new drainage provision to prevent water entrapment.

by Harold Singletary, Staff *Engineer*
Materials and Processes

WATER IN THE DORSAL FIN

Several reports of water entrapment inside the dorsal fin have prompted a production change at Hercules aircraft Lockheed serial number LAC 5058 for drainage provisions in the forward end of the dorsal.

How does water get into the dorsal and become trapped? One would think that the dorsal would stay dry since the flanges on the dorsal and vertical stabilizer which mate to the upper surface of the fuselage and horizontal stabilizer are fay surface sealed.

If, however, the airplane is parked in a nose-low attitude on uneven ground such as a slope on the wash rack, rain and washing solutions will flow forward from the rudder well over the horizontal stabilizer into the dorsal. There the water will remain until the attitude of the nose is raised sufficiently to allow the fluid to flow aft and out by way of the route of entry.

When a Hercules aircraft remains on the ground in a nose-low attitude for several days in rainy weather, the accumulation of water in the dorsal can be considerable. One incident of water entrapment resulted in drainage of about 40 gallons of liquid from the dorsal into the cargo compartment when a bolt that secures the cargo door uplock was removed.

DORSAL DRAINAGE

LAC 5058 and up

Drainage provisions in the dorsal fin on LAC 5058 and up are authorized by Lockheed drawing 337651. These provisions consist of two parallel joggles in the dorsal flange approximately four inches behind the forward end of the dorsal. The joggles, which look like bumps in the flange, produce an opening between the fuselage skin and flange of 0.12 inches in height and 1.5 inches in length.

Aircraft prior to LAC 5058

Operators with geographical and environmental conditions which are conducive to water collection in the dorsal should consider the value of adding drain outlets near the forward end of the dorsal on their Hercules aircraft built prior to LAC 5058. They have a choice of drain installations, since the following three procedures have been authorized by Lockheed engineering for in-service Hercules aircraft.

Procedure 1

The first offers the most efficient dorsal fin drainage provision. This is the hole-and-slot passage illustrated

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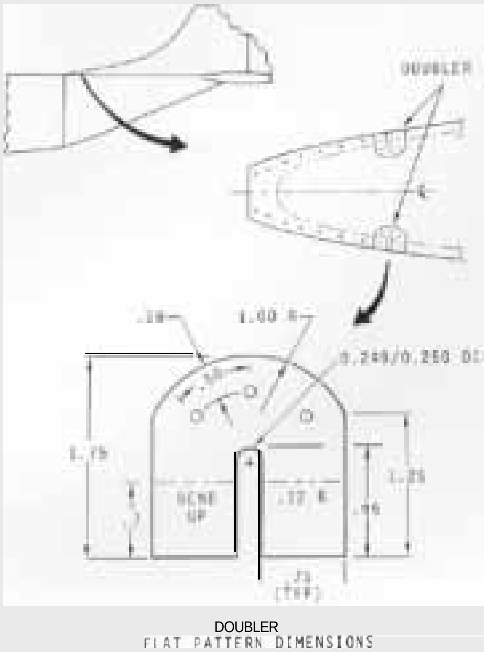


Figure *I.* Dorsal Fin Drain Provision: Procedure 1

in Figure 1. Since the installed drainage points are close to the forward end of the dorsal, and the drain slot. extends to the fuselage presssure skin, the following installation provides nearly complete drainage:

I. Remove existing rivets No. 8 and No. 9 from each side of the forward end of the dorsal.

2. Drill a 1/4-inch diameter drain hole centered between rivets No. 8 and No. 9.

3. Slot the flange of the dorsal in line with the hole to the outboard end of the flange.

4. Fabricate two doublers as shown in Figure 1 from 0.040-inch 2024-T3 clad aluminum alloy sheet.

5. Hand-form the doublers with a 0.12-inch radius to nest on top of the dorsal.

6. Finish the doublers with epoxy primer.

7. Install the doublers wet with MIL-S-81733 inhibitive sealant on the surfaces that mate with the dorsal and pressure skins, using five M7885/2-4-2 blind fasteners (three added holes and two existing holes) wet with MIL-S-81733 sealant.

8. Topcoat the doubler installations with two coats of MIL-C-833286 polyurethane of the same color as the surface adjacent to the doublers.

Procedure 2

Procedure 2 promotes dorsal fin drainage, but not as effectively as the hole-and-slot passage described above. Since the installed drain hole is about 1/2 inch above the low point, the collected water will not drain completely. Simpler than the hole and slot procedure, the following procedure calls for drilling two holes in the dorsal fin:

1. Drill a l /Cinch diameter hole in each side of the

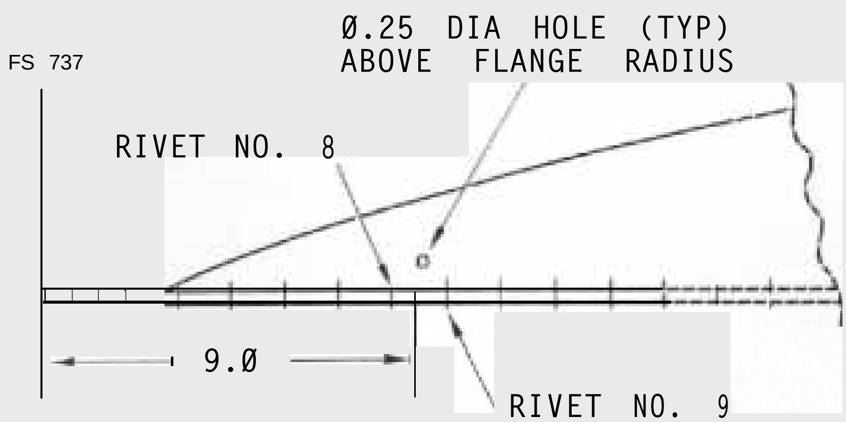


Figure 2. Dorsal Fin Drain Provision: Procedure 2

dorsal approximately 9 inches aft of the dorsal leading edge, between rivets No. 8 and No. 9 and above the flange radius (see Figure 1).

2. Treat the edge of the two holes with chemical conversion coating MIL-C-5541 and touch up the paint of the exposed metal.

Procedure 3

The simplest procedure for promoting dorsal fin drainage is to remove a rivet as follows:

1. From the lower row on the vertical leg of the angle that attaches the dorsal and pressure skin, remove the second or third flush rivet (see Figure 3).

2. Enlarge the rivet hole to 1/4-inch diameter.

3. Treat the hole with MIL-C-5541 conversion solution and paint the exposed metal.

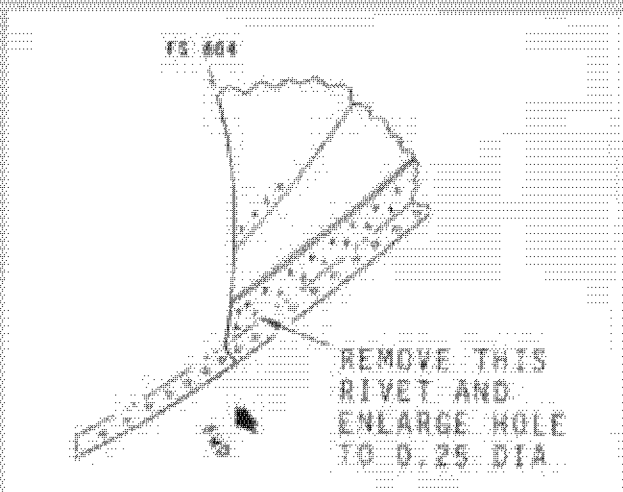
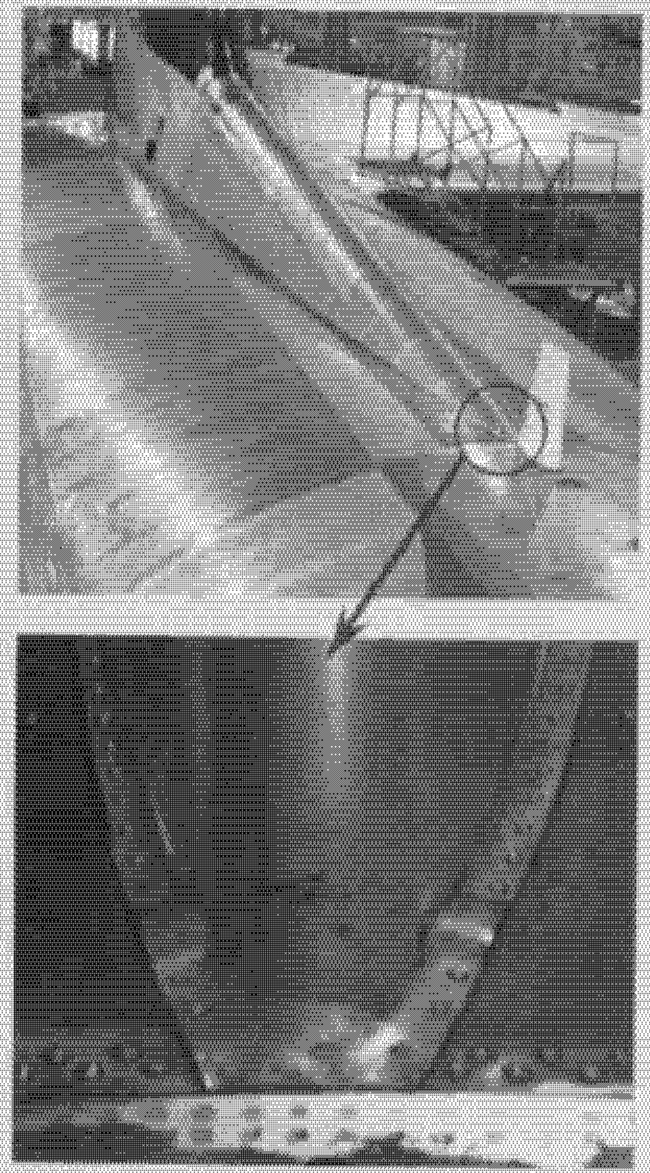


Figure 3. Dorsal Fin Drain Provision: Procedure 3

The disadvantage to this procedure is that the forward end of the angle is approximately 37 inches aft of the dorsal fin leading edge. This places the drain hole about 1/2 inch above the low point, which means that, like the drainage provision described in Procedure 2 above, drainage will not be complete.

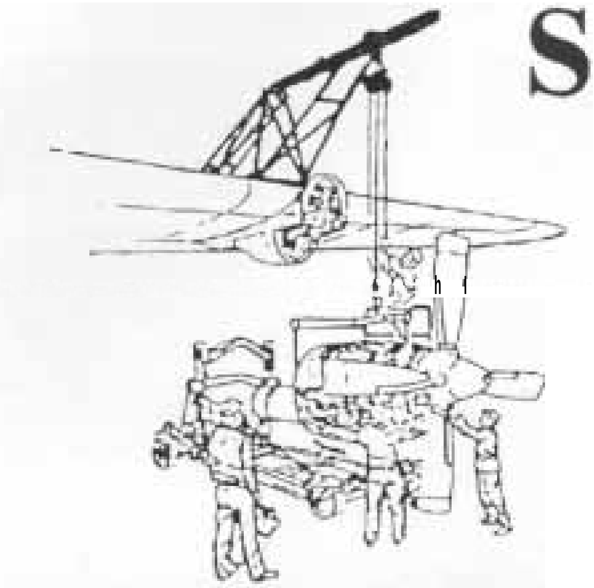
AVOIDING DAMAGED CONNECTORS

There are occasions when the drain passages in the bulkhead at the rear of the dorsal become clogged, trapping water in the cavity on the back side of the bulkhead. In such instances, the water often damages electrical connectors that penetrate the fuselage pressure skin in that area. This situation can be prevented by periodically pushing a small wire, such as an unfolded paper clip, through the drain passages to clear them of debris. There are two passages through the bulkhead, one at each outboard end of the spanwise angle that connects the bulkhead web to the top of fuselage pressure skin at FS 956. With the passages clear, water can run forward to the drain outlets newly installed in the forward section of the dorsal, leaving the electrical connectors high and dry.



Drain outlets are in joggle at forward end of dorsal.

GAGING SAFETY BY THE THREAD



When Using the Over-the-Wing Engine Hoist

Over-the-wing engine hoist assemblies are familiar pieces of equipment (see Figure 1). Available in several different configurations, they have been in general use by Hercules aircraft operators throughout the world for many years. The very familiarity of these convenient hoists is a tribute to the practicality of the design. Familiarity can be a mixed blessing, however, and nowhere is this more true than where matters of safety are concerned.

When using an over-the-wing engine hoist, it is extremely important that careful attention be paid to all the details of the way the hoist is attached to the wing. The use of bolts of the wrong type and grip length, improper installation techniques, or the presence of corroded or damaged threads on the bolts or in the nuts of the attach points might result in the hoist being inadequately secured. This could pose a significant safety hazard, with potential for damage to equipment or injury to personnel.

There are two specific areas involving the over-the-wing hoist attachment point hardware that require strict attention to proper maintenance practices.

The first has to do with the attach points themselves. The fasteners that are installed in the hoist attach points when the hoist is not in use are standard structural fasteners and must be of the proper length to prevent rust or corrosion of the barrel nut due to exposed threads. Figure 1 shows the various bolt sizes and locations to bc used on specific Hercules aircraft model designations. Shown in Figure 2 are typical nut plate and barrel nut locations.

When installing the structural fasteners after using the over-the-wing hoist, remember that the fasteners should be installed wet with Products Research and Chemical Company Low-Adhesive Sealant No. PR1403G, which contains a rust inhibitor. If the PR1403G sealant is not available, use MIL-S-8784

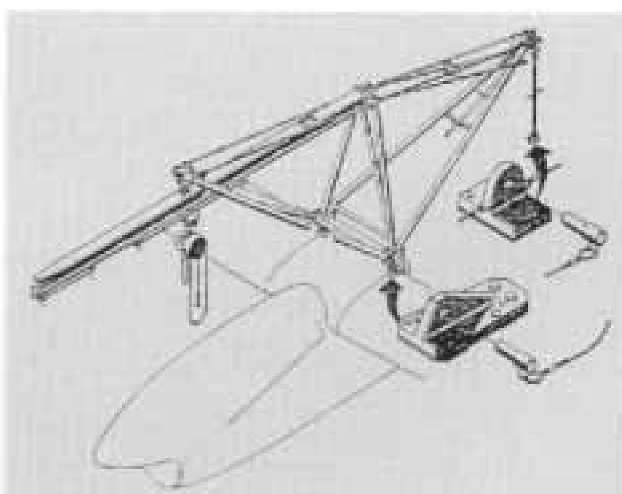


Figure 1. PN 3400665-1 Portable Engine Hoist Assembly

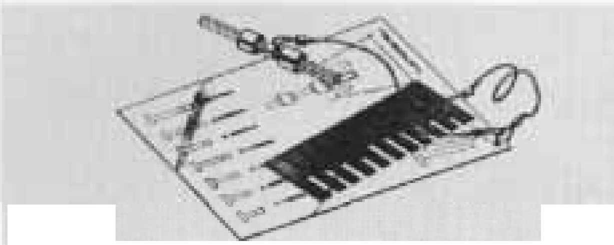


Figure 3. PN 3403141 Bolt and Gage Set

sealant. MIL-S-8784 does not contain a rust inhibitor, so apply LPS-3 to the threads prior to sealant application.

The other hardware to be considered when using the over-the-wing engine hoist are the bolts used to attach the hoist to the wing. It is critical that these bolts be of the proper grip length, particularly those installed into the aft attach point barrel nuts. The bolts at this location handle much of the tension load imposed by the weight supported by the hoist. Bolts of insufficient grip length at the aft bracket attach points may pull out of the wing under load.

The instructions that apply to the hoists typically specify that NAS 6604 or NAS 6605 bolts be used, depending on mounting point location. As far as bolt length is concerned, it might appear that the correct size bolt to use for attaching the hoist to the wing would be approximately l/2 inch longer than the thread-protecting bolt that was removed from a particular location. After all, the hoist attach bracket PN 341288 that is used on all installations has a total thickness of 0.525 inch (bracket plus pad).

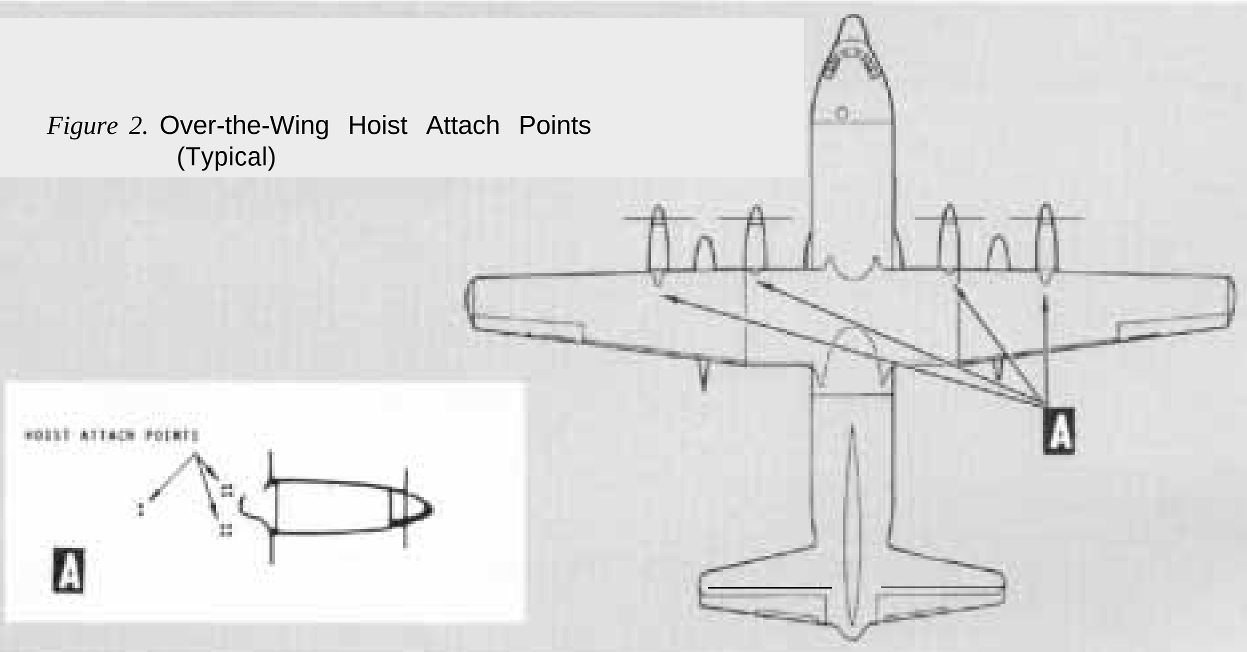
This could be dangerous assumption, however, if the installed bolt is not of the proper length. For this reason, it is highly advisable to measure the individual bolt locations at each attach point to verify the minimum length needed.

There are several methods by which this may be accomplished, but the quickest and easiest is to use the tool specifically developed for this job. The PN 3403141 bolt and gage set (see Figure 3) accurately measures the bolt hole on the wing and indicate the size and length of the bolts needed.

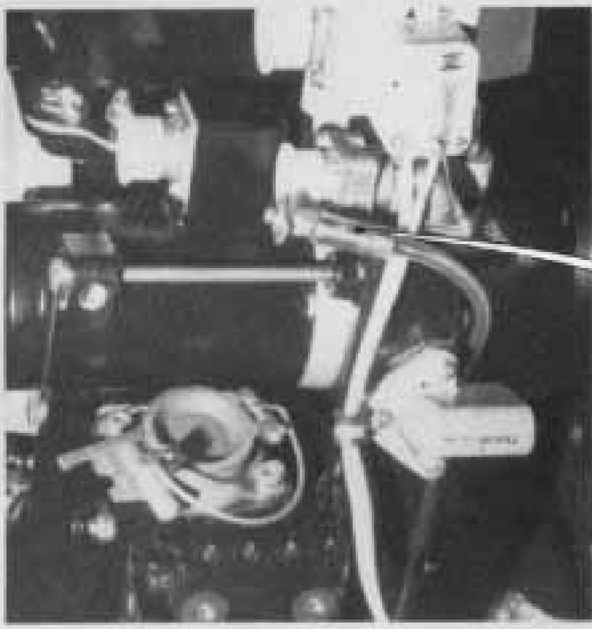
Manufactured by Lockheed-Georgia Company, the PN 3403141 bolt and gage set consists of gages for the various size and lengths of bolts and a gage pin to measure depth. The gages are dimensioned to provide bolt tolerances. The pin has a sliding sleeve for taking bolt hole depth measurements. The length can be determined on the gage. The set components are tied together with retention cables and are stored in a pouch which can be attached to the over-the-wing hoist assembly.

Whatever measurement method you decide to use, do measure. And do use bolts of the correct type and of sufficient grip length to secure the hoist properly. Play it safe. Don't let familiarity breed contempt for safety for you or your organization.

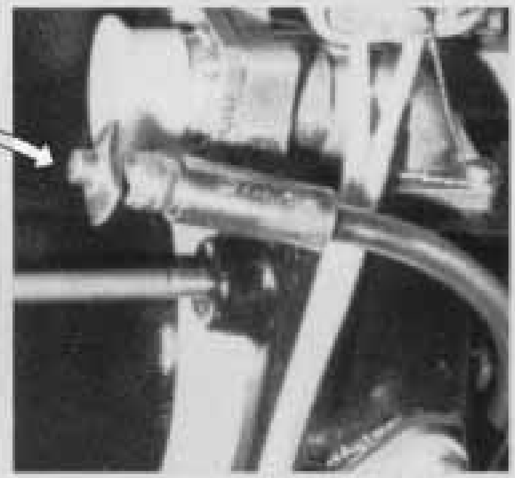
Figure 2. Over-the-Wing Hoist Attach Points (Typical)



Using the ATMOSPHERIC SUMP



DIPSTICK



An atmospheric sump dipstick was incorporated in the pump housing assembly of the 54H60 propeller some years ago to make it possible to check or service the propeller control assembly oil quantity more easily and more accurately than with the original dipstick, which measured the oil quantity in the pressurized sump.

Although the authorized maintenance manuals still contain instructions for determining propeller oil quantity using either dipstick, most 54H60 propellers manufactured in recent years have omitted the pressurized sump dipstick entirely. For these units, there is of course no choice as to which dipstick to use. But even for other units which contain both dipsticks, the atmospheric sump dipstick offers the best method of establishing a safe operating level for the prop oil. To understand better why this is so, it is useful to review how the system works.

PRESSURIZED SUMP

There are two oil reservoirs in the propeller control oil system, the pressurized sump and the atmospheric sump. The pressurized sump is the reservoir for the main, standby, and auxiliary (feather) pumps. To prevent cavitation of the pumps at high altitude, this reservoir is pressurized at 15 to 20 psi.

The hydraulic pressure required for operating the propeller pitch changing mechanism is supplied by the pumps located in the pressurized sump. Most of the output from the pumps returns to this reservoir. However, return oil from the pitchlock regulator pressurizing and regulating valve ends up in the atmospheric sump by way of the propeller barrel and beta feedback gear. Oil that is used for lubrication or involved in internal leakage also drains back into the atmospheric sump.

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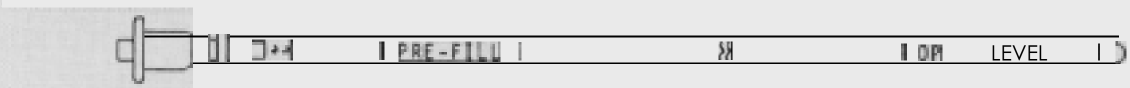
ATMOSPHERIC SUMP

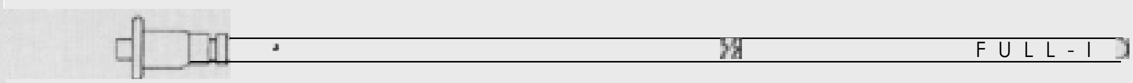
The atmospheric sump is the reservoir for the main and auxiliary scavenge pumps. These pumps keep the pressurized sump supplied with oil and maintain 15 to 20 psi pressure in the sump.

It is important that the oil level in the atmospheric sump be kept at the correct level for the scavenge pumps to perform properly. If the oil level in the atmospheric sump is allowed to become too low, the scavenge pumps will cavitate, introducing air into the oil system. The result can be inadequate oil in the pressurized sump. If the pressurized sump reaches a 2-quart low condition, a propeller oil low indication will be given. This could mean having to shut down an engine and feather a prop.

On the other hand, if the oil level in the atmospheric sump is too high, other types of problems can develop. The usual result of overservicing the propeller control assembly is that oil is forced out of the propeller around the lip seal. This leads to lip seal damage and continuing propeller oil leakage.



ORIGINAL



CURRENT

READING THE DIPSTICK

The original atmospheric sump dipstick or oil level indicator bore markings for a PRE FILL range and an OP LEVEL range. The current dipstick has only a FULL level indication. Hamilton Standard Service Bulletin HS Code 54H60 No. 101, Revision 1, dated October 15, 1981, provided instructions and authorization for changing the earlier dipstick markings on commercial aircraft to the current configuration.

Similarly, T.O. lC-130B-2-11 and T.O. lC-130H-2-11 contain instructions for modifying the original dipsticks on military aircraft to remove all but the lowest of the OP LEVEL markings. The remaining mark serves the same purpose and measures the same oil level **as** the FULL marking on newer atmospheric sump dipsticks.

Simplifying the dipstick markings has eliminated most of the confusion that used to arise concerning the interpretation of dipstick readings. However, improper checking and servicing of the atmospheric sump is still **a** cause of propeller problems from time to time. These problems are typically the result of overservicing rather than underservicing. As far as propeller control oil level is concerned, it is important to bear in mind that this is one area where more is definitely not better.

CHECKING PROPELLER CONTROL FLUID LEVEL

Using the atmospheric sump dipstick is the perferred method of determining the propeller control oil level. A brief review of the routine propeller servicing procedure using the atmospheric sump dipstick (oil level indicator) is given below. As always, consult the appropriate maintenance publication before undertaking this activity **on** the aircraft.

Before You Start. . .

There are several things that should be **kept in mind** before you proceed with the oil level checking procedure.

First, note that it requires two people to carry out the procedure properly, one in the flight station and one at the propeller. Be sure a qualified assistant is available before you begin.

Next, remember that when you check the propeller control oil level, the oil in the unit should be at its normal operating temperature. If the weather is very cold outside, 0 degrees C (32 degrees F) or below, and the propeller has been exposed to low temperatures for awhile, it will also be necessary to warm the propeller hub (using warm air or by running the engine) until the oil temperature is 60 to 80 degrees C. If this is not accomplished, propeller blade seal damage and oil leakage will result when the propeller is cycled during the servicing procedure.

Take care to see that engine oil is not used in the propeller control system. Except for a few special applications, hydraulic fluid specification MIL-H-83282 is used in all aircraft maintained according to U.S. military specifications. Most commercial Hercules aircraft use hydraulic fluid specification MIL-H-5606 for propellers and other applications where hydraulic fluid is specified.

If any engine oil is accidentally introduced into the propeller control and circulated thorugh the unit (in other words, the propeller has been operated since the engine oil was added), it will be necessary to remove the propeller and control for replacement of all performed packaging.

Be sure to take all necessary precautions to keep foreign substances such as rain, snow, sand, or blowing dust from entering the unit during servicing.

It is necessary to run the auxiliary pump during the checking and servicing procedure in order to cycle the propeller and pressurize the pressurized sump with fluid. Be sure to observe the duty cycle of the auxiliary pump motor when carrying out this operation.

The pump motor may be operated up to a maximum of 60 seconds at a time, followed by a cooling-off period equal to the time of operation. For example, on for 40 seconds followed by off for 40 seconds. The normal maximum total running time during any half-hour period is two minutes, but the motor may be operated as long as the temperature of the motor body does not exceed 150 degrees F, or 65.6 degrees C. An easy way to monitor the motor temperature is to feel the motor body with your bare hand. If it is too hot to keep your hand on for more than 5 seconds, it is time to let the motor cool off for awhile.

To operate the auxiliary pump and change blade pitch during servicing, select the desired blade pitch angle with the throttle lever while holding the appropriate condition lever in the AIR START position to energize the pump motor.

Feathering of the propeller may be accomplished by moving the condition lever to the FEATHER position. The prop may also be feathered by pulling out the fire emergency handle. The operation of the auxiliary pump motor and resulting blade pitch operation may be stopped at any time by moving the condition lever to the GROUND STOP position or pushing in the fire emergency handle.

The master propeller low oil quantity light on the engine instrument panel has the function of illuminating to warn the flight crew when one or more propellers are approximately 2 quarts low on oil in the pressurized sump. There are four propeller low oil warning lights on the copilot's side shelf, one for each propeller, to identify which of the propellers has low oil. If one of these lights illuminates while the auxiliary pump is being operated during the servicing procedure, stop the motor and add fluid to the propeller control atmospheric sump.

When oil is to be added to the propeller control, remove the top left forward engine cowling, remove the valve housing cover cap on the left side of the control housing, and add the required amount. Be careful not to overfill. One inch on the dipstick is equal to approximately 14 fluid ounces. If it is necessary to remove oil from the propeller control because of overfilling, for example, siphon it from the pressurized sump.

When adding fluid to the propeller control, exercise care not to get fluid on the electrical brush assembly or the deicer contact rings. Fluid spilled in these areas may cause electrical shorting of the brushes and deicer rings, and scorching of the brush housing. If some propeller oil accidently comes in contact with the brush assembly, clean the area with Federal specification PD-680, Type II, solvent. Be sure the area is dry again before running the engine.

ATMOSPHERIC SUMP OIL LEVEL CHECK PROCEDURE

1. Connect an external source of AC power to the airplane.

2. Remove the top right forward engine cowling (or open the access door provided on later aircraft).

3. If more than 30 minutes has elapsed since the last engine run, cycle the propeller from FEATHER to REVERSE at least 3 times, stopping with the throttle at GROUND START for the commercial model and GROUND IDLE for the military model. Hold the condition lever at the AIR START position for at least 20 seconds after the propeller reaches the GROUND START (GROUND IDLE for military) position.

4. With the auxiliary pump still operating, remove the atmospheric sump dipstick and wipe it with a clean, lint-free cloth. Insert and lock the dipstick in its tube. Then remove the dipstick and check the oil level. The fluid level should be indicated on the dipstick, but should not exceed the FULL (or lower OP LEVEL) mark. Add or remove oil as necessary to achieve this indication.

5. Restore the engine to normal configuration.

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