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New Heat Exchangers

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Cover: In Volant Rodeo 1983, teams from eight nations demonstrated their skills in the world's best tactical airlifters.

Focal&pint

FRANK L. FITTS

Keeping Cool

When flying machines first took to the air, the only environmental control available in the cockpit in winter was the number of layers of clothing the pilot might choose to wear. In summer it was perhaps even worse. Only the relative cool of the slipstream a thousand feet up could provide relief on a sweltering day.

Times have changed. Today we expect the environment inside our airplanes to be just about as comfortable as that of our homes. This means heating, cooling, and even pressurization to keep the cabin altitude no higher than that of a cozy mountain retreat. The environmental control system of the Hercules aircraft is designed to meet all of these expectations. It does so, and with such efficiency and dependability that it is easy to lose sight of how much human ingenuity and advanced technology are involved in making these vital creature comforts so readily accessible.

Dependability in mechanical systems never evolves by chance. The environmental control system of the Hercules aircraft is monitored constantly by Lockheed engineering to ensure that it always performs in accordance with the design parameters. We constantly review reports from Hercules operators, Field Service personnel, and overhaul facilities in order to discover and remedy any design deficiencies or system faults.

The article in this issue of service News magazine which discusses the new. tubular heat exchangers reflects one design change that has come about as a direct result of field experience. The change will increase system capability while reducing maintenance requirements. One might say that it is the kind oi improvement that will help both the airplane and the maintenance specialists who work on it keep cool.

The new heat exchangers represent the kind of change that involves redesigninga major component. More often, improvements are of a somewhat subtler nature. A change of this type. and another example of action taken in response to field reports, concerns the filter used in the bleed air supply line to the outflow valve jet pump. Maintenance records have shown that this filter requires frequent cleaning, which means the expenditure of man-hours for disassembly, cleaning, and reassembly. The problem prompted a design review, which showed that the typical size of the contaminant particles is quite small in comparison to the jet pump nozzle opening. It was concluded that the filter could be eliminated altogether without any adverse effect on system performance. The filter in question will therefore be deleted on all new production aircraft starting with Lockheed serial number LAC 5022. The change will also be recommended to all current Hercules aircraft operators for retrofit.

Engineering surveillance of the environmental control system-and the other major operating systems of the Hercules aircraft-is part of an ongoing commitment at Lockheed. The commitment is to search continuously for ways to increase the value of our products to our customers. It is one of the many special ingredients that go into making the Hercules airliiter what it is--unique.

Sincerely,

Frank L. Fitts
Staff Engineer

PRODUCT SUPPORT LOCKHEED-GEORGIA COMPANY MARIETTA, GEORGIA 30063

T.J. Cleland Director

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New Heat Exchangers for the Hercules Aircraft

by Robert W. Campbell, Special Courses Instructor
Frank L. Fitts, Staff Engineer

The new Hercules aircraft currently being assembled at Lockheed-Georgia's main production facility in Marietta, Georgia, are being equipped with improved air conditioning system heat exchangers. New, tubular heat exchangers have been installed in both the cargo compartment and flight station air conditioning systems on all Hercules airplanes beginning with serial number LAC 4947. The new units replace the fin-and-plate type heat exchangers that were previously used in these locations on later H-model Hercules aircraft.

This engineering change takes advantage of advancing technology in the area of aircraft air conditioning to enhance the overall performance of the Hercules aircraft environmental systems. The change is also expected to significantly reduce maintenance costs. Analysis of field reports extending back over a number of years revealed that the plate-type heat exchangers are subject to clogging by sand and debris when aircraft equipped with them are operated for a period of time under severe environmental conditions, such as from unimproved airfields in arid regions. The new heat exchangers are designed to virtually eliminate problems of this kind.

Plates Versus Tubes

The reason that the plate-type heat exchangers proved vulnerable to operational difficulties in regions where the atmosphere contains a heavy burden of suspended solid particles can be found in the details of their internal construction.

In a plate-type heat exchanger, the unit's core consists of flat, plate-like elements interconnected by closely spaced fins. The purpose of the fins is to aid in the dissipation of heat, and the plate-type heat exchanger is in fact quite efficient in this regard. But experience has shown that this design also tends to trap soil particles and bits of debris contained in the cooling air that is directed through the heat exchanger's core from outside the aircraft. These solid particles accumulate over time, and eventually they can build up enough to block the air flow.

It is primarily the close spacing of the fins in the core that leads to problems of this type. The fin spacing is only approximately one-sixth of an inch, which means that the core may become plugged by even a relatively modest amount of ingested debris. Blockage of the core passages leads to poor performance and overheating, and subsequent maintenance action to clean the unit in order to restore normal efficiency. Operation in a sandy or dusty environment is thus likely to mean that frequent cleaning will be required to keep a plate-type heat exchanger functioning properly.

The new tube-type heat exchanger contains tubular core elements that are spaced widely enough to ensure that air can circulate around and past the elements freely. A heat exchanger of this design can be built to operate efficiently, and it is much less likely to catch and retain solid particles borne by the stream of cooling air flowing through the unit. The tube-type heat exchanger is therefore considerably more forgiving when used under difficult environmental conditions. It can provide dependable service even in an atmosphere contaminated by substantial amounts of particulate matter.

Other Features

Another advantage of the new tube-type heat exchanger now used in the Hercules aircraft is that it eliminates the need for a heat exchanger anti-icing system. The plate-type heat exchanger requires an anti-icing system because the closely spaced fins at the ram air face--the point at which the incoming ram air first

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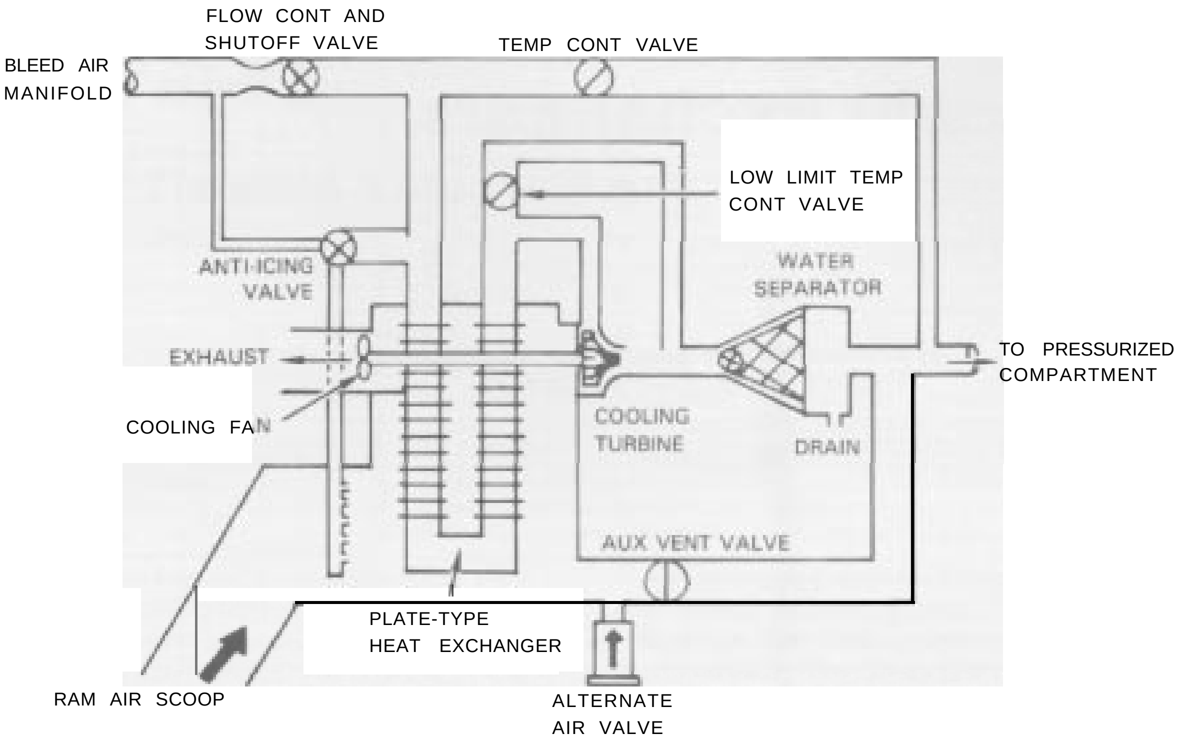


Air conditioning system schematic-most Hercules aircraft from LAC 4579 to LAC 4946.

comes in contact with the core-is insufficiently heated to prevent ice formation under some conditions that could be encountered in flight. An anti-icing system is therefore required in order to prevent ice from blocking the ram air flow into the heat exchanger during such time. The new heat exchanger does not require an anti-icing system because the temperature of the core tubes at the ram air face is high enough to prevent any significant ice formation.

The tube-type heat exchanger installation also includes a practical new feature: a water spray system. When the air conditioner is on, drainage from the water separator is injected into the heat exchanger plenum across the ram air face of the core tubes. A supply tube leading from the water separator routes condensate water to a jet pump mounted on the plenum. The pump uses bleed air to spray the water on the core tubes. The evaporation of the water from the surface of the tubes augments the action of the ram air in cooling the heat exchanger elements. This results in improved efficiency and greater air conditioner cooling capacity. The effect is particularly noticeable when the air conditioning system is operated on the ground or at low altitudes, where temperature and humidity tend to be highest.

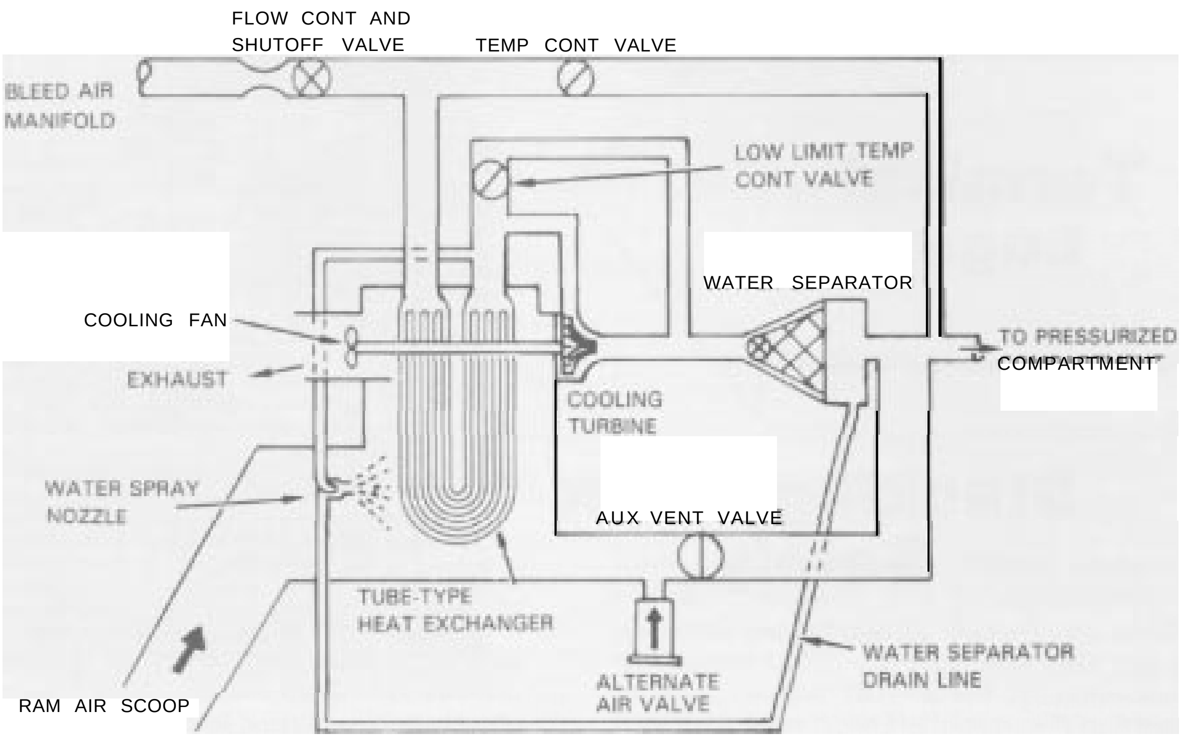
Maintenance Advantages

The foremost advantage of the new heat exchangers is reduced cost of maintenance. This comes about mainly through elimination of the frequent cleanings necessary to keep the old units free of obstruction. The new heat exchangers do not require cleaning except under truly unusual circumstances. This is a particularly important factor in arid climates, where problems with clogged heat exchangers have been a common nuisance item in the past.

The improved performance of the new heat exchangers under all operational conditions has other, perhaps less obvious, maintenance advantages. For example, when a heat exchanger becomes plugged with dirt and debris, the bleed air passing through its core cannot be adequately cooled. The air being supplied to the cooling turbine is therefore warmer than it should be. This affects not only the ability of the air conditioning system to maintain the desired cabin temperature, but the service life of the turbine and other air conditioning system components. Upgrading the performance and reliability of the heat exchanger can actually upgrade the performance and reliability of the entire environmental control system.

Modifying Existing Plate-Type Systems

The plate-type heat exchanger is no longer in production and is not being carried as a spare. This means that when it becomes necessary to replace a heat exchanger of this type, the replacement will be a tube-type unit. Some initial investment of time and money is involved in converting from the plate-type heat exchangers to the tube-type units, but on balance the benefits make the



Air conditioning system schematic-LAC 4947 and up

change both desirable and economically sound.

The modification work required to convert an existing air conditioning system to accept the new, tube-type heat exchanger can be accomplished by field-level maintenance organizations or at overhaul, whichever the individual operator finds more convenient. The conversion procedure is quite straightforward; no special tools or unusually difficult modification steps are involved.

All conversion work should be done according to the instructions contained in the appropriate service bulletins. Hercules Service Bulletin 82-503 covers foreign military aircraft Lockheed serial number LAC 4653 to LAC 4946 inclusive. Service Bulletin 382-21-12 is applicable to all L-100 commercial aircraft Lockheed serial numbers LAC 4673 through LAC 4923. The information contained in these service bulletins has been submitted to the U.S. Air Force and the U. S. Navy for their information, with the recommendation that a TCTO be issued. In all cases, the proper Hercules Service Bulletin should be used in conjunction with AiResearch Service Bulletin 5-2354. A copy of this service bulletin is provided with each conversion kit.

Conversion kits and all other parts needed for changing over to the new, tube-type heat exchangers are available from Lockheed. The part number 830218-l conversion kit contains all parts and materials necessary to modify one air conditioning system-except the new heat exchanger itself. New heat exchangers, part number 191390-2-1, must be ordered separately. Two kits and two heat exchangers are required if both air conditioning systems of a particular airplane are to be modified; however, one system on a given aircraft may be converted individually and the aircraft operated that way until a suitable occasion arises to carry out the modification on the other system.

There are a couple of other items concerning the changeover that are worth noting. We have already mentioned that the new, tube-type heat exchangers require no special provision to prevent the formation of ice on the heat exchanger core during flight. The existing heat exchanger anti-icing system is therefore unnecessary, and its components may be removed or deactivated at the user's option. In cases where the flight station control panel has been left in place after the rest has been rendered inoperative, the panel should be placarded "SYSTEM DEACTIVATED."

Another part of the conversion that is described as optional in the service bulletins perhaps should not be. That is the installation of the water spray system. Although a tube-type heat exchanger will function without the water spray system, its efficiency and cooling capacity will be reduced. To get the full benefits of the changeover, both in terms of effective performance and enhanced service life for other components in the air conditioning system, the water spray system should always be installed.

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Terminal Lugs:

Stacking Them Safely

by Joe Parnigoni
Service Analyst

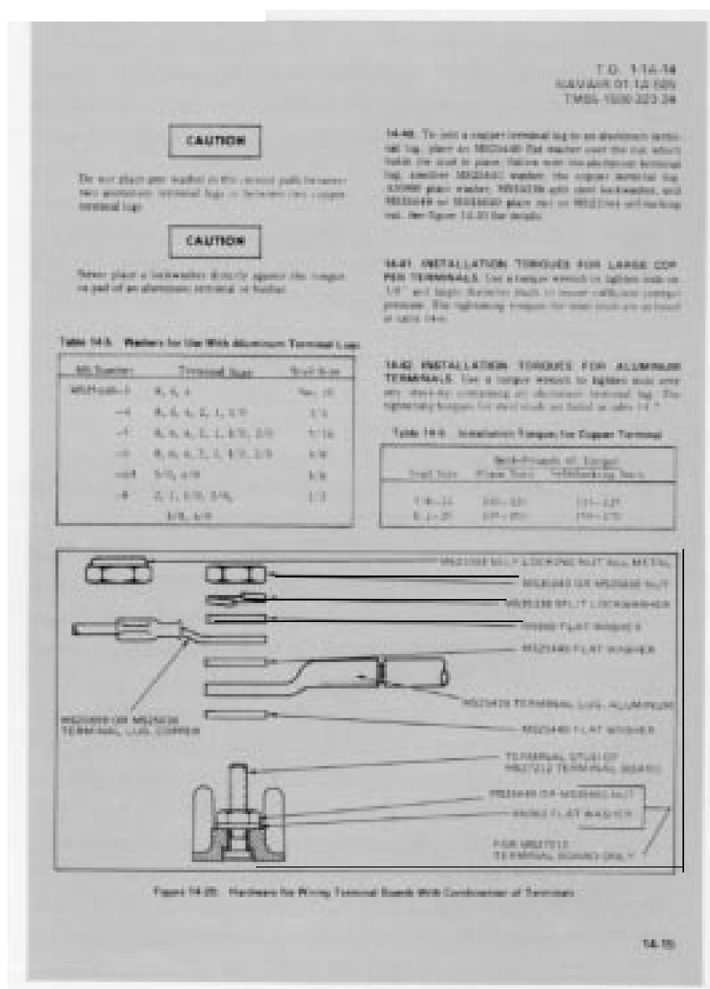
The Hercules aircraft has miles and miles of electrical wiring throughout its structure to control its many operating systems. Every one of these wires has some type of electrical hardware at its ends to allow the wire to be attached to electrically operated components, buses, or other wires. When two or more wires are to be connected together at a terminal stud, terminal lugs are attached to the wire ends, and then the lugs are fastened to a terminal board, terminal block, or terminal strip assembly.

The technical manual entitled "Aircraft Electric and Electronic Wiring Installation Practices," (T.O. I-IA-14/NAVAIR Ol-lA-505/TM55-1500-323-24) dated 15 February 1982, describes in Chapter 14 how wire terminal lugs are to be connected to terminal boards. Unfortunately, some of the information in this chapter can prove misleading as far as the Hercules aircraft is concerned; if it is used as a guide for making connections with certain kinds of terminal lugs, loose connections may result. In this article we would like to identify the problem areas and offer some recommendations that should help Hercules aircraft operators avoid trouble from this source.

Problems of "Security"

The crux of the problem centers on Figure 14-20 (Figure 1) of the installation practices manual. This illustration shows the recommended hardware needed to wire terminal boards utilizing a combination of terminal lugs. The difficulty is that if the stack-up of hardware shown in the figure is used to connect a copper terminal lug and an aluminum terminal lug to a ter-

Figure 1. **Figure 14-20 of the installation practices technical manual. See Figures 4 and 5 for recommended changes.**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CAUTION

CAUTION

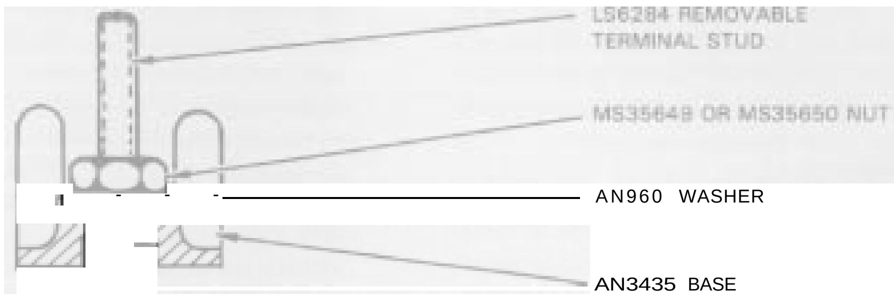


Figure 2. **Typical LS6456/MS25123 terminal board assembly with removable stud.**

minal board, the nut may work loose because of the lack of sufficient stud threads to properly secure it.

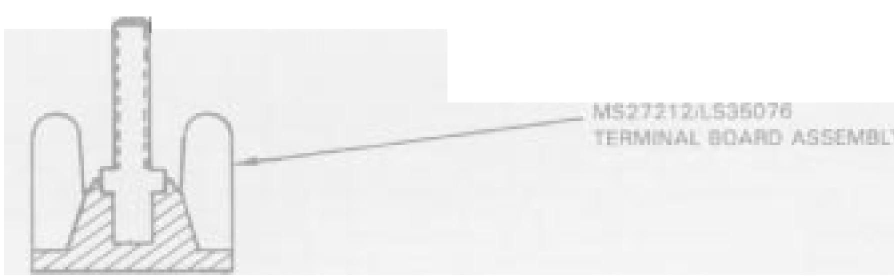
This is exactly what has happened on a few Hercules aircraft at terminal boards TB143A, TB143B, TB144A, and TB144B. These terminal boards are located in the cargo compartment: TB143A and TB144A are located at the left wing pressure break and TB143B and TB144B are near the right wing pressure break. Terminal boards TB143A, TB143B, TB144A, and TB144B are connection points for copper and aluminum lugs in the No. 1, No. 2, No. 3, and No. 4 AC power supply circuits. If the nut on one of these terminal boards works loose, power from one of the engine-driven generators could be interrupted.

Terminal Board Types

There is no single outstanding deficiency about Figure 14-20 that leads to the problem of insufficient stud length; rather, it is a combination of factors. A little background information about the terminal boards used on Hercules aircraft will be helpful at this point. Two kinds are involved. Many Hercules aircraft were originally equipped with terminal boards with removable studs (Figure 2). The basic part number of the terminal boards with removable studs used at the TB143A, TB143B, TB144A, and TB144B locations is LS6456-10. More recent Hercules aircraft have generally been equipped with terminal boards which have the studs molded into the unit base (Figure 3). The basic part number of the molded-in stud type terminal boards used at the TB143A, TB143B, TB144A, and TB144B locations is either MS27212-5 or LS35076-5. The -10 in the part number for the removable stud terminal board, and the -5 in the part numbers for the molded-in stud terminal board indicate that the stud threads have an outside diameter of 3/8 of an inch.

Figure 14-20 shows an older-type terminal board, the one with removable studs, but the annotation “FOR MS27212 TERMINAL BOARDS ONLY” implies that it is the newer type. The MS35650 nut and AN960 washer shown would also be inappropriate for use with the MS27212 (or LS35076) terminal board since the newer-type board contains molded-in stud terminals,

Figure 3. **Typical MS2721 2/LS35076 terminal board assembly with molded-in stud.**



and nuts and washers are not required to hold them in place. This suggests a way to gain more stud threads for properly securing a nut on the molded-in stud type of terminal board. If it is found that stud-retaining nuts and washers have been installed on the newer-type terminal boards, remove them; they are not necessary.

Additional Strategies

When you are working with the older-type terminal board, nuts and washers are of course needed to secure the studs. If a stud appears to be too short in this case, or if a stud on one of the newer-type terminal boards seems too short even though no unneeded nuts or washers are present, some other method of obtaining the required additional stud length will have to be employed. The way that Lockheed recommends is to replace the two MS25440 washers called for in Figure 14-20 with NAS1070 washers.

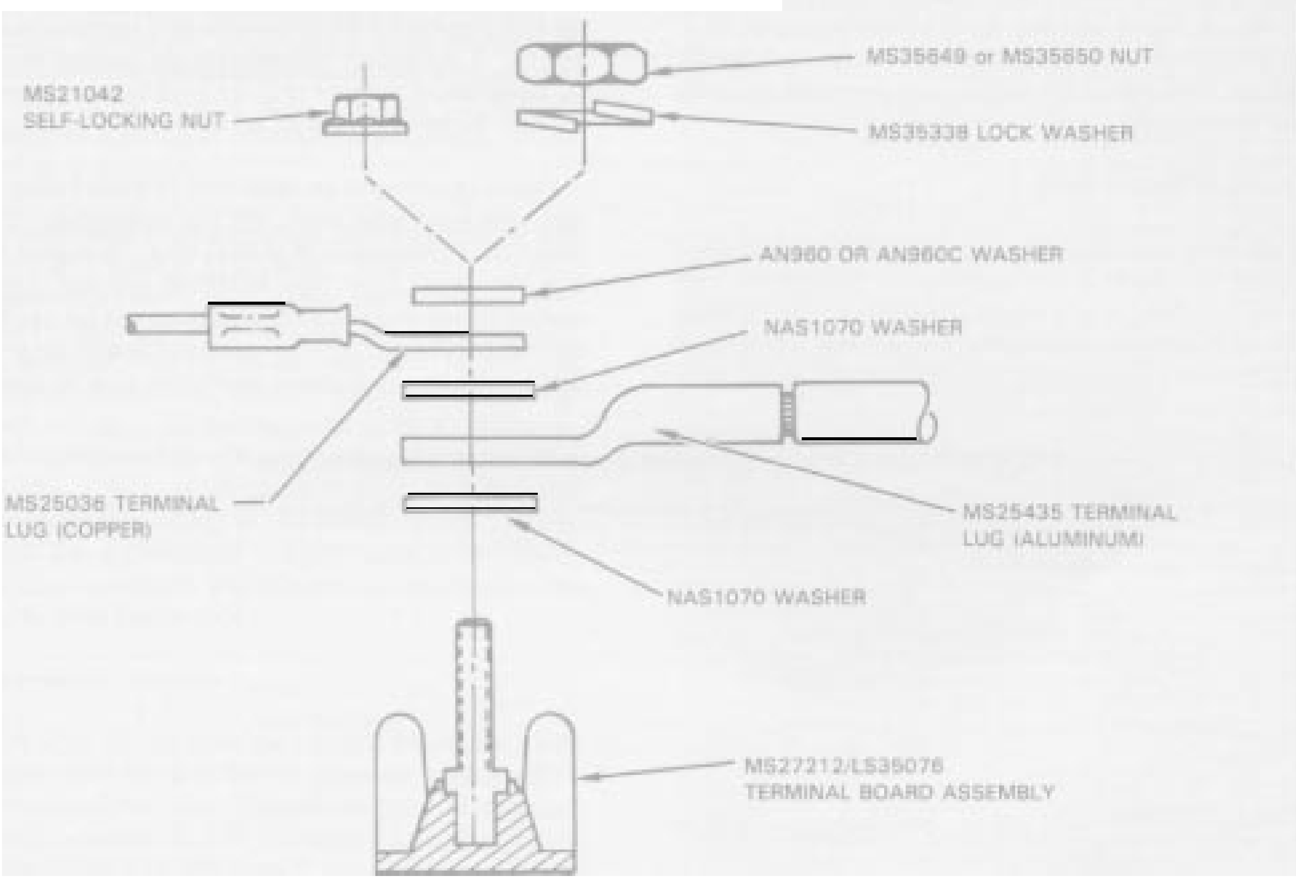
The reason for the change has to do with the different thicknesses of the two types of washers. MS25440 washers are about 0.125 inch thick, while NAS1070 washers measure only about 0.063 inch in thickness. The use of the thinner washers in a stack-up will provide additional space on the stud to allow the nut to grip the threads securely. At the TB143A, TB143B, TB144A, and TB144B locations, the washers that are normally used are MS25440-6 washers. Lockheed recommends replacing them with NAS1070-616 washers. It may be noted that the NAS1070-616 washers are slightly smaller in diameter than the MS25440-6 washers, but the available contact area is still sufficient to carry the current load.

The removal of any unnecessary nuts and the use of thinner washers should take care of the stud-length problem, but there are some other matters of concern in connection with Figure 14-20 of the installation practices manual that we would like to bring to your attention.

Mixes That Match

Figure 14-20 (Figure 1) has two callouts for AN960 washers. This washer is fine for the application, but it has come to our attention that some people may be using another washer that has almost the same part

Figure 4. Recommended stack-up **when attaching copper** and **aluminum terminal lugs to terminal boards with molded-in studs.**



number. Sometimes AN960D washers, which are common MSP (bench stock) items, are being substituted for AN960 washers. The AN960D washer is not to be used here because of the material from which it is made. The AN960 washer is made of cadmium-plated carbon steel, while the AN960D washer is made of aluminum. In this application, the use of an AN960D washer would put an aluminum washer next to a copper terminal lug, which should never be done because of the increased possibility of galvanic corrosion. A washer that could be substituted for the AN960 washer is an AN960C washer, which is made of corrosion-resistant steel.

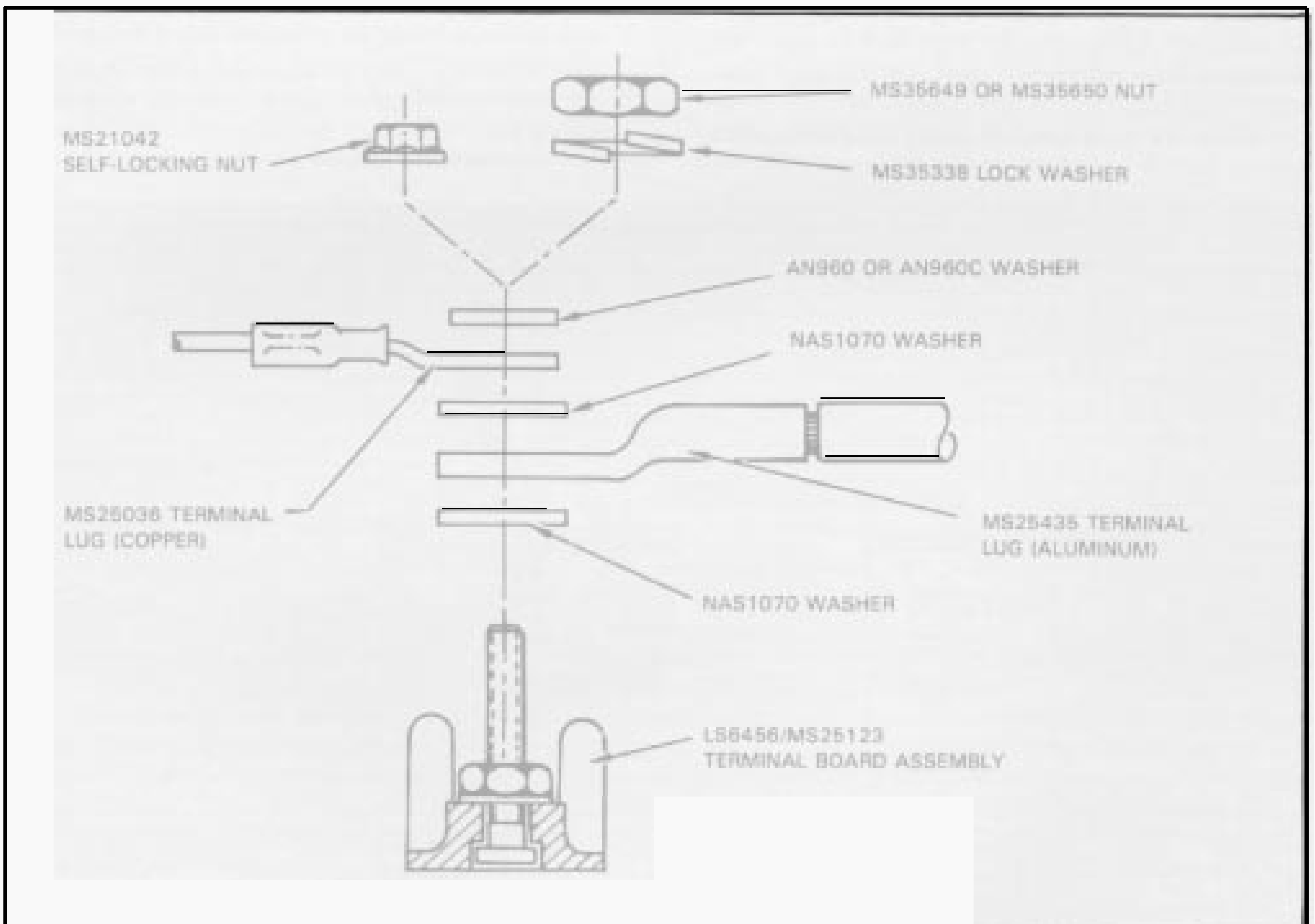
Tightening Things Down

The next item of concern with respect to Figure 14-20 is the "MS21044 SELF-LOCKING NUT ALL METAL" callout. This nut is no longer readily available in supply. Consequently, some supply organizations have been known to substitute MS21044 self-locking nuts with non-metallic inserts. This type of self-locking nut is not acceptable in this application because the non-metallic insert cannot withstand the heat developed during high current flow. The MS21044 nut with a plastic insert is also about 0.25 inch deeper than the all-metal self-locking nut, which sometimes does not allow sufficient stud thread engagement for the self-locking insert to have any effect. Since the all-metal MS21044 self-locking nut is not readily available, and since the non-metallic insert MS21044 self-locking nut is not acceptable, Lockheed recommends using an MS21042 self-locking nut, which is specified in military standard MS27212. This nut is all metal and readily available.

We would also like to draw your attention to paragraph 14-40. This paragraph refers to Figure 14-20 and states that "... MS35338 split steel lockwasher, and MS35649 or MS35650 plain nut or MS21044 self-locking nut" are to be used to secure the stack of hardware. This implies that the lock washer is to be used even when a self-locking nut is to be used. Lockheed feels that when using a self-locking nut, the need for a lock washer is eliminated. This is another way of ensuring that there are adequate stud threads to properly secure a nut.

Figures 4 and 5 sum up and illustrate Lockheed's recommendations to ensure that there are adequate stud

Figure 5. Recommended stack-up when attaching copper and aluminum terminal lugs to terminal boards with removable studs.



threads to properly secure a nut and to ensure the safety of the connection.

The recommendations that we have described can also be applied to two other illustrations in the installation practices technical manual even though in these cases there is no problem with insufficient stud threads. Figures 14-18 and 14-19 show the way to stack up hardware when connecting two copper terminal lugs to a terminal board and when connecting two aluminum terminal lugs to a terminal board. When referring to the figures from the installation practices technical manual that we have mentioned, remember the following:

- AN960 washers and MS35649 or MS35650 nuts that are normally used to secure the studs on LS6456 terminal boards should not be used to "secure" studs on terminal boards with molded-in studs.

- To make extra stud length available and ensure adequate threads, replace MS25440 washers with NAS1070 washers.

- If a self-locking nut is to be used in the stack-up, use an MS21042 self-locking nut instead of an MS21044 self-locking nut, and delete the requirement for a lock washer.

Checking the Torque

There is one more item concerning Chapter 14 of the installation practices manual that should be noted with particular *cure:* Lockheed feels that the torque values shown in Table 14-7 entitled "Installation Torques for Aluminum Terminals" are not adequate for terminating aluminum terminal lugs or a combination of aluminum and copper terminal lugs because of the cold-flow characteristic of aluminum. This tendency of aluminum hardware to compress slightly under pressure will lead to loose terminations when the torque values shown in Table 14-7 are used, and could cause a high-resistance joint. A high-resistance joint will cause a heat buildup which could lead to a fire. Since the lack of adequate torque is the most common cause of an aluminum lug termination failure, Lockheed recommends using the torques listed in the following table instead of those shown in Table 14-7 of the installation practices manual. It may be noted that the values shown below agree with the values that were listed in Table 14-7 of the manual before change one became effective 15 March 1983.

STUD SIZE	INCH-POUNDS OF TORQUE
5/16	135-165
3/8	220-250
1/2	440-470

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Keeping the Front Beam Clean

by Harold J. Singletary
Materials and Processes Staff Engineer

Soot is one of the constituents of the engine exhaust of the Hercules aircraft. It consists largely of carbon particles, but it also contains a variety of chemical compounds, including sulfur compounds. This combination has a significant potential for inducing corrosion, and soot will in fact cause damage if it is allowed to remain in contact with aluminum aircraft structure.

On exterior surfaces, soot is visible and can be washed away, if it is not embedded into the paint. When soot penetrates to interior surfaces, such as it can do particularly during engine thrust reversal, it is not so easily seen or dislodged. One such area is inside the leading edge of the Hercules aircraft outer wing.

Soot that collects on the outer wing box front beam and inside surfaces of the leading edge will not be seen until the leading edge is removed. A buildup of soot inside the leading edge is commonplace if specific action is not taken to keep engine exhaust gases out.

Contamination Paths

On Hercules aircraft built prior to serial number LAC 4498, exhaust gases from the engines can get into the leading edge area in two ways. The first way is through gaps at the upper and lower hinge joints where the leading edge attaches to the outer wing box and between individual sections of the leading edge panels at the chordwise splices. These paths were eliminated on production aircraft starting with Hercules aircraft LAC 4498 by sealing the hinge joints and chordwise splices.

The other way that contamination can get into the leading edge is through 5-inch diameter openings in the rear beam of each outer wing box which lead into the outer wing dry bay. From the dry bay, contamination passes into the leading edge area through an opening in the front beam for the leading edge anti-icing system. This path was eliminated on production aircraft starting with LAC 4542 by adding flapper valves over the openings in the rear beam.

Leading Edge Paths

During thrust reversal, a significant amount of engine exhaust is forced forward across the exterior surfaces of the wing by the propellers. As the exhaust gases and soot pass the leading edge, some contamination penetrates the unsealed gaps at the hinge joints and the chordwise splices on Hercules prior to LAC 4498. Once inside the leading edge cavity, soot clings to exposed surfaces and is then difficult to dislodge.

To keep contaminants from entering the hinge joints and chordwise splices, these areas were sealed during production with a fluid-resistant aerodynamic sealant on Hercules aircraft LAC 4498 and up. This sealant, specification MIL-C-83982/STM40-207, is a polyurethane sealant which is resistant to weathering and to chemicals that are used during maintenance. Lockheed recommends that operators possessing Hercules aircraft built prior to LAC 4498 seal the areas in question. Similarly, if a leading edge section has to be removed on aircraft that have already been sealed,

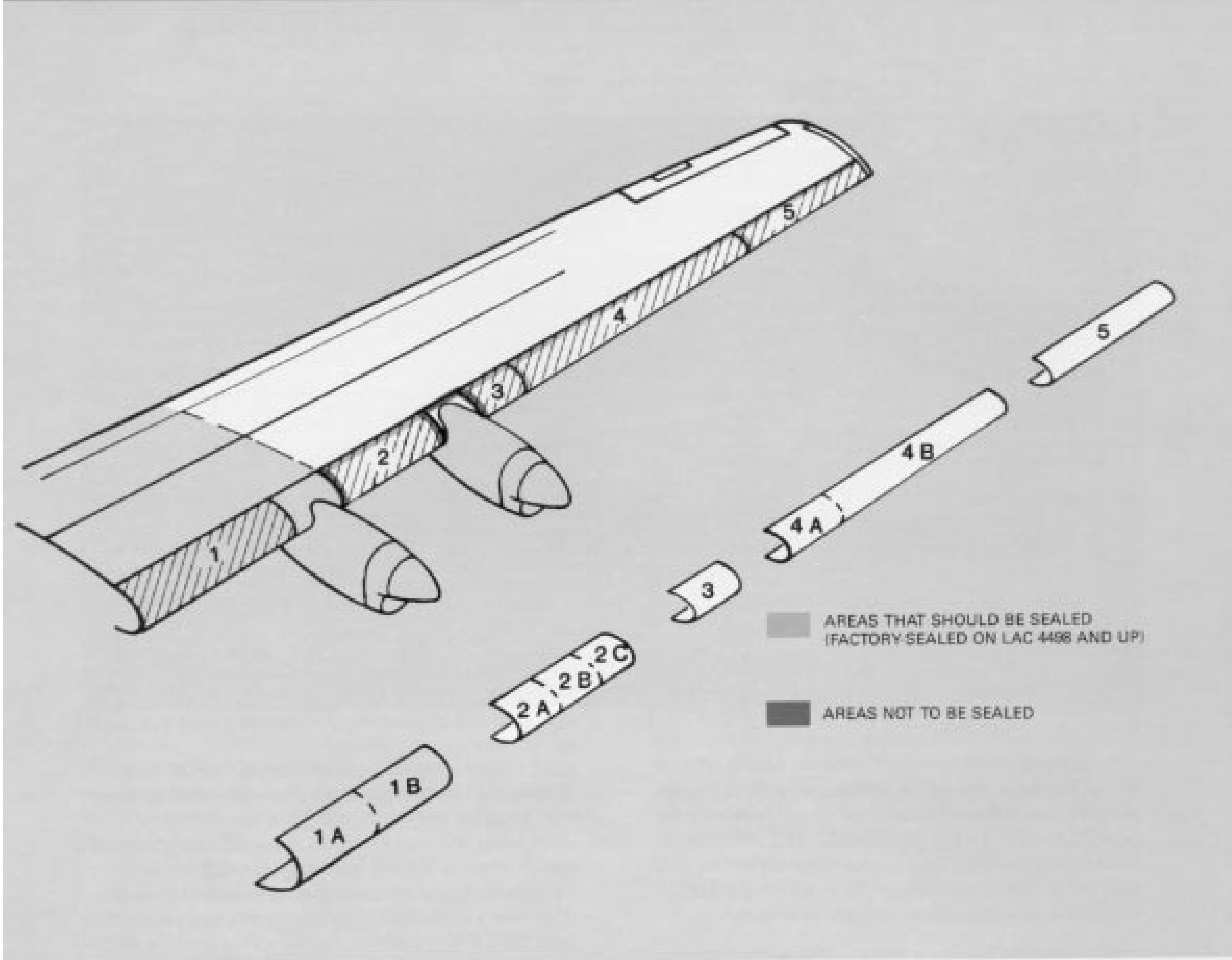

Figure 1. The outer wing should be properly sealed to exclude contamination.

the sealant should be replaced after the leading edge is reinstalled to prevent entry of contamination.

Sealant Replacement/Installation

When sealant is to be replaced after a leading edge section has been removed, all traces of the old sealant must first be cleaned away. Using a plastic or wooden tool with a sharpened edge, scrape away the old sealant that was damaged when the panel was removed. Figure 1 shows the areas that were originally sealed on production Hercules aircraft LAC 4498 and later. It also shows those areas that should and should not be sealed if you are sealing the leading edges for the first time. Note that the areas that are not supposed to be sealed are those areas around the nacelle upper access panels (horse collar fairings).

After all damaged sealant has been removed from the gaps around the leading edge, clean the gaps thoroughly with 1,1, 1-trichloroethane and a bristle brush. This and all subsequent steps should be done whether you are replacing sealant or installing it for the first time. After the gaps are clean, wipe them dry to remove all excess solvent.

When applying 1,1,1-trichloroethane, it is best to use a wash bottle so that the solvent can be confined to a small area. This will help limit the user's exposure to the toxic effects of the solvent. Even so, be sure to perform the cleaning task in a well-ventilated area. The use of a wash bottle has an additional advantage in that it provides a clean supply of solvent at each application.

With the gaps cleaned and dried, apply masking tape to both sides of the upper and lower leading edge hinge line gaps and to both sides of the chordwise gaps that are to be sealed. Remember to refer to Figure 1 when determining which chordwise gaps are to be sealed.

When installing sealant for the first time, the gap immediately aft of the upper and lower leading edge

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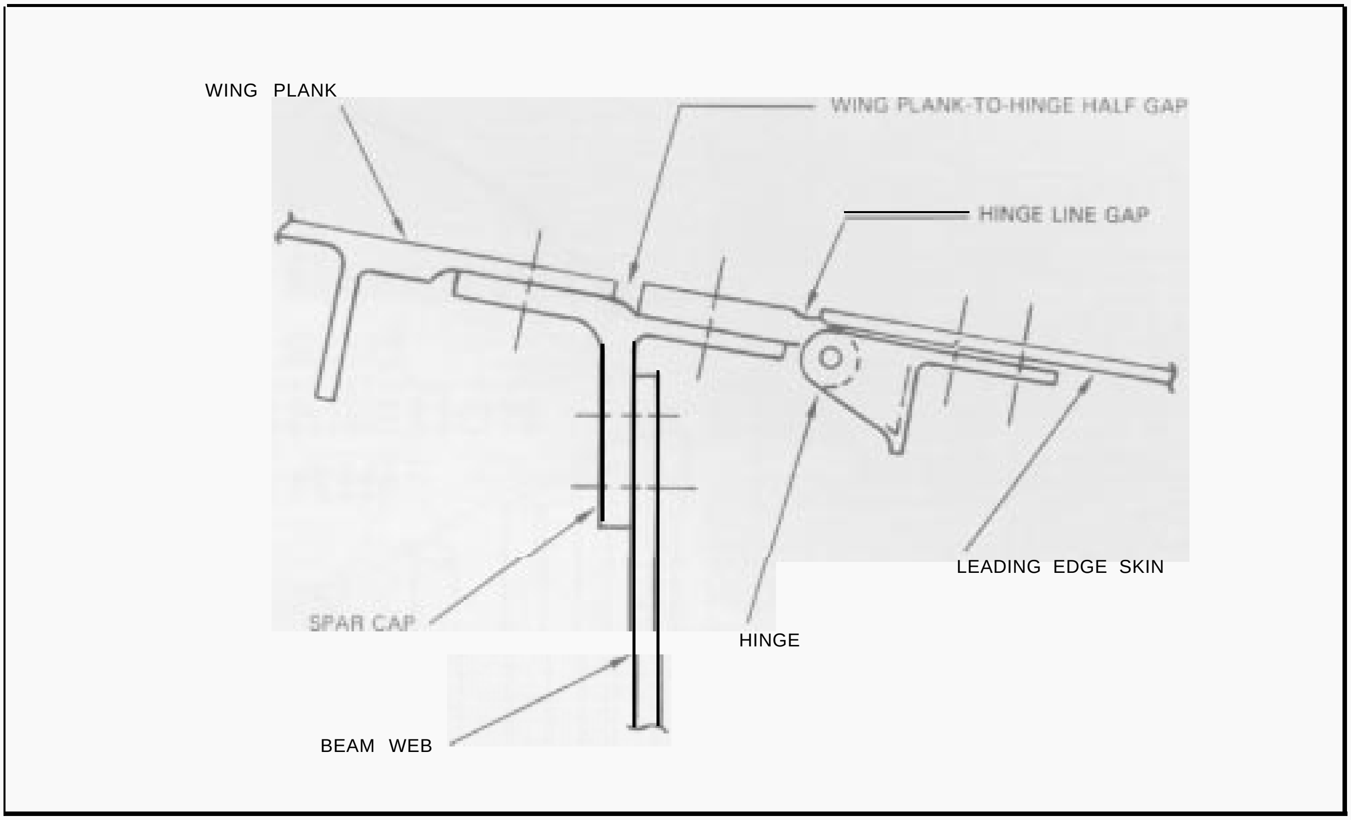


Figure 2. Apply sealant to the upper and lower hinge line and wing plank-to-hinge half gaps.

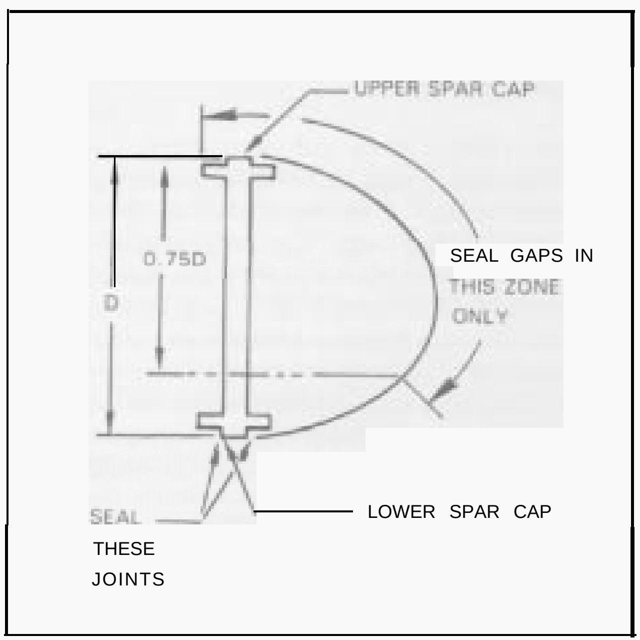
hinge lines should also be sealed. This gap is shown in Figure 2 and is formed where the wing plank and the hinge half are attached to the spar cap. On airplanes that were sealed during production, the wing plank-to-hinge half gap sealant is not disturbed when the leading edge is removed. For first-time application of sealant, be sure to include the wing plank-to-hinge half gap when following instructions for the hinge line gap.

Another thing to note is that the chordwise splices are not to be sealed around their full circumferences. Figure 3 illustrates the extent of the area to be sealed. This allows the lower part of the chordwise splice gap to remain open so that any condensate or other fluids inside the leading edge can drain out.

After the masking tape has been placed on both sides of all gaps to be sealed, apply a coat of B. F. Goodrich PL-106 primer to the prepared gaps. Allow the primer to dry for a minimum of 30 minutes. After the primer has dried, apply B. F. Goodrich PL-410, Class B-2 polyurethane sealant over the primer. The sealant can be inserted into the gaps with a wooden or plastic spatula. The sealant should then be smoothed to the level of the adjacent masking tape. Finally, remove the masking tape as soon as the sealant becomes tack-free.

This procedure will prevent the entry of contaminants through the leading edge gaps, but it won't stop contamination from getting inside the leading edge unless the path through the outboard dry bay is also eliminated.

Figure 3. **Leave the lower portion of the chordwise gaps unsealed to allow any trapped fluids to escape.**



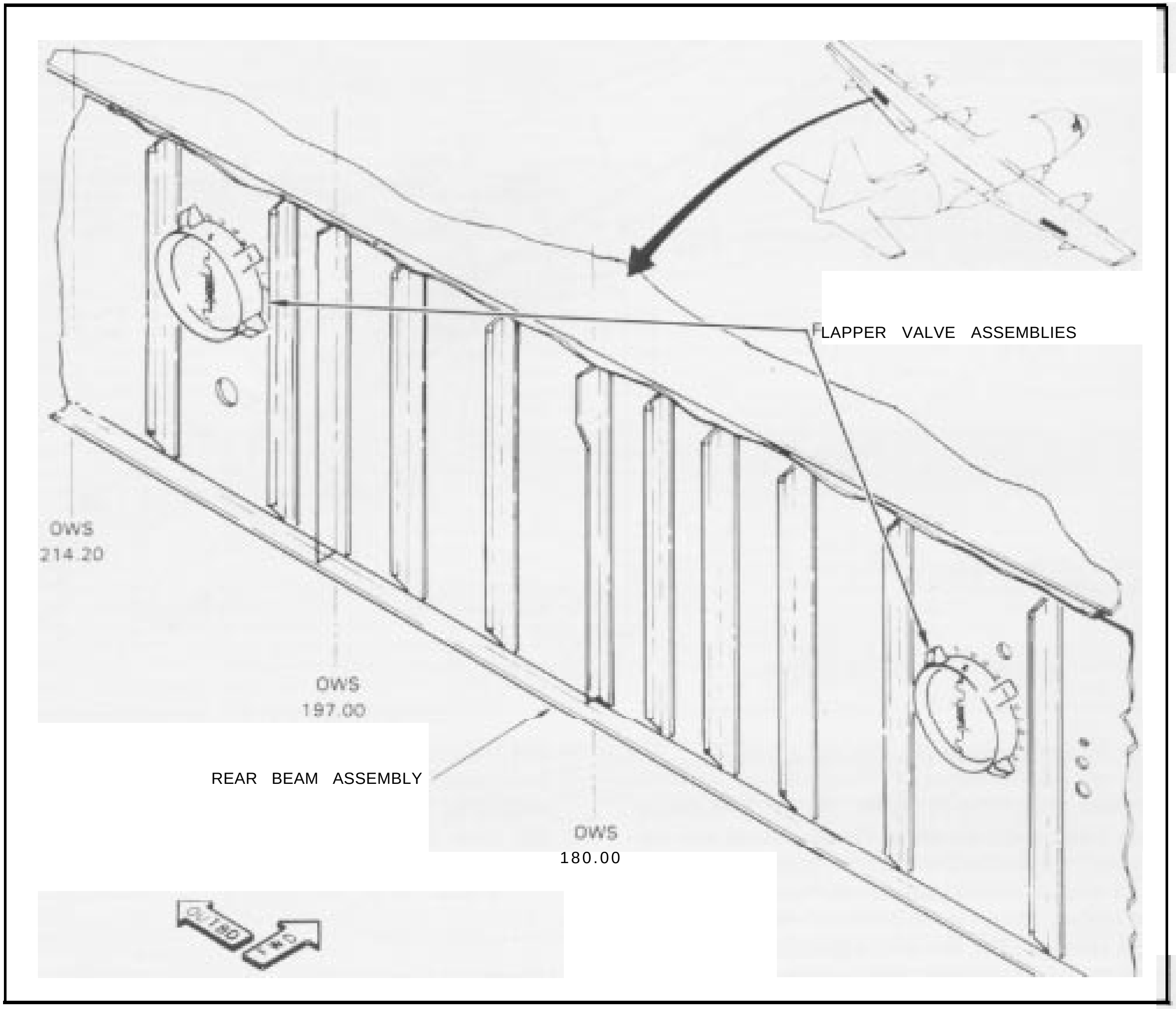


Figure 4. **Flapper valves were incorporated on new production aircraft beginning with LAC 4542 to block the passage of contaminants through the dry bays.**

Rear Beam Path

Engine exhaust gases and contamination can get inside the leading edge on Hercules aircraft prior to LAC 4542 by way of the No. 1 and No. 4 dry bays. When the leading edge anti-icing system is not operating, engine exhaust can enter the outboard dry bays through 5-inch diameter openings in the rear beam. There are two such openings behind each outboard dry bay, which were originally covered with wire screens on the early Hercules aircraft. Once inside the dry bays, engine exhaust gases and soot continue forward through another opening in the front beam for the leading edge anti-icing system.

Flapper Valve Installation

Soot contamination through the dry bays is prevented on Hercules aircraft LAC 4542 and later by the presence of flapper valves that were installed during production (Figure 4). The flapper doors close any time the leading edge anti-icing system is not operating. Provisions were made for commercial and foreign military operators to modify their airplanes by issuing Service Bulletins 382-132 and 82-298. Once the flapper valves are installed, this path of contamination is eliminated.

Installation of flapper valves and sealing the leading edge gaps has greatly reduced the amount of contamination that can enter the leading edge area on later Hercules aircraft. If you have problems with corrosion and soot contamination on the front beams and the structure inside the leading edges, it may do well to consider implementing the solutions described here.

Prop Removal and Installation Aid

Anyone who has removed and installed Hercules aircraft propellers using a Type J-1B Portable Engine or Turret Crane, specification MIL-C-6497, or similarly designed cranes, knows that one of the difficulties that is often encountered is getting close enough to your work. Because of the design of the J-1B crane, positioning B-5 stands close enough to the propeller to work safely and with any degree of convenience can be difficult. By modifying an extra J-1B crane that happened to be on hand, one of our operators found that removing and installing propellers could be done with much more efficiency and convenience.

We thought that what this operator accomplished would be interesting to our readers and we are grateful to Loreto Gordoncillo of FAZA, the Republic of Zaire, and Fred Beach, Lockheed Field Service Representative, for sharing the details with us. In considering this modification, the reader should be aware that Lockheed engineering has not evaluated the changes described from the standpoint of any possible effects on the structural strength or safety of the affected equipment, nor has such a modification been attempted at Lockheed. We are passing the information along as a matter of interest only.

The modification involved attaching a work platform to the J-l B crane. One end of a platform 83 inches long by 47 inches wide was welded to the upright structure of the crane 106 inches above floor level. The other end of the platform, which uses an expanded metal floor like the ones used on B-4 and B-5 stands, was supported by welding two angle supports to the platform and anchoring the other ends to the base of the crane.

After the platform was secured to the J-1B crane, the boom was adjusted to establish an 11.5inch gap between the hoist cable and the end of the platform. The 11.5inch clearance provides adequate room to raise and lower propellers.

To make the platform safer to work from and more accessible, rails and steps were added. The operator also made a drip pan which could be attached to the platform to catch prop dome oil when the dome is removed. The drip pan was fitted with a tube which allows oil to be drained into a suitable container on the floor. After the oil is drained from the dome, the drip pan can be removed for cleaning.

All the parts that were used to modify the crane were obtained from the base salvage yard. The platform with the expanded metal floor, the angle supports, steps, and rails were taken from old maintenance stands; the drip pan was manufactured from an old automotive fuel tank.

When a J-1B crane modified in this way is available, only one piece of ground equipment is needed to remove or install a propeller. The modified crane provides a convenient, fixed platform of the proper height for removing and installing propellers, and helps reduce both the time and effort involved in carrying out this maintenance task.

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