

## CHAPTER 2

### WATERTIGHT CLOSURES, INSPECTION, AND MAINTENANCE

#### 2-1. STEEL CLOSURES.

2-1.1 SAFETY. Before starting repairs to any watertight fitting, obtain permission from the chain of command to disable a watertight fitting. Make an entry in the ship's closure log and safety tag-out log as appropriate. Check with the supervisor before starting work. Do not disassemble any watertight fitting while the vessel is underway, and accomplish only those emergency repairs required to keep that particular fitting operational. Do not sacrifice the ship's watertight integrity by totally disassembling a hatch or door below the waterline because of worn bushings, especially when the ship is in a busy sea lane. Exercise common sense.

If a hatch or scuttle cover is removed for repairs, rope off and cover the area to prevent personnel from falling into the opening. Fasten or lash back any closure that must remain open while work is being accomplished to prevent the closure from swinging as the ship rolls.

If possible, try to start and finish the work on the closure in the same work day. This will prevent having an additional open closure after working hours when a minimum of the crew is on board. Have on hand all parts needed for repair of the closure before starting the work. Report to your supervisor when you have completed repairs. Remove red safety tags, and clear the entry in the ship's closure log.

#### **WARNING**

**Ensure the hatch escape route is free of personnel before securing the hatch.**

2-1.2 GENERAL GUIDANCE FOR INSPECTIONS. The following principles apply to inspections for all watertight closures:

- a. Comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series, which is found in each work center.
- b. All tag-out procedures shall be in accordance with current shipboard instructions.
- c. Exercise extreme caution when working around open trunk areas.
- d. Accomplish inspection and maintenance semiannually, or more frequently if adverse conditions have been encountered. Adverse conditions include:
  1. Weather Decks - Constant exposure to elements and heavy usage.
  2. Interior Spaces - Heavy passage of personnel or equipment through openings.
- e. Loose, missing, or damaged parts and parts showing excessive wear must all be replaced.
- f. Doors, hatches, and scuttles should routinely be inspected by Damage Control Petty Officers, Work Center Supervisors, and Zone Inspectors for:
  1. Loose, missing, and damaged parts.
  2. Paint, rust, and other foreign matter on gaskets, knife-edges, and working parts such as bushings, link-ages, and brackets.

3. Binding and difficult operations.
4. Distortion and deterioration of metal surfaces.
5. Hinge pin wear and pins that are not properly secured.
6. Gasket joints must be minimized. No more than one joint on closures with all radius corners. Splices are not permitted.
7. Gasket cracks, deterioration, hardness, permanent set over 1/8-inch deep, and gaps due to shrinkage where gasket ends meet.
8. Obstructed access to escape scuttles.
9. Packing plungers intact and stick packing adequate (except on closures with self-lubricated bushings).
10. Broken or missing spring clips.
11. Missing special purpose wrenches (dogging wrenches, T-wrenches, and engineer's wrenches).

If any parts are missing or beyond repair, replacement parts can be obtained through the Navy Supply System. Refer to the Afloat Shopping Guide and appendix C for listings of the most commonly needed repair parts. Other parts for which the Navy Supply System does not maintain stock can sometimes be obtained on a special order basis by forwarding a description of the part needed and nameplate data from the closure to the Navy Ship's Parts Control Center (SPCC), Mechanicsburg, PA. Additional assistance can be provided by Naval Surface Warfare Center, Carderock Division - Ship Systems Engineering Station (NSWCCD-SSES), Attn: Code 9780, Hull Outfitting, Philadelphia, PA, DSN 443-7344, Commercial 215-897-7344. If parts are not in stock (NIS) or not carried (NC) by the supply system, open purchases can be made. Refer to [appendix C](#).

### 2-1.3 KNIFE-EDGE AND DOOR FRAME INSPECTION.

- a. Open the fitting. Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. See [figure 2-1](#), [figure 2-2](#), and [figure 2-3](#). The maximum acceptable variation for knife-edge straightness is plus or minus 1/16 inch. The maximum acceptable warpage of the door frame is 1/8 inch. If frame/coaming warpage is excessive, or if the knife-edge straightness is not within tolerances, initiate action to replace the closure.

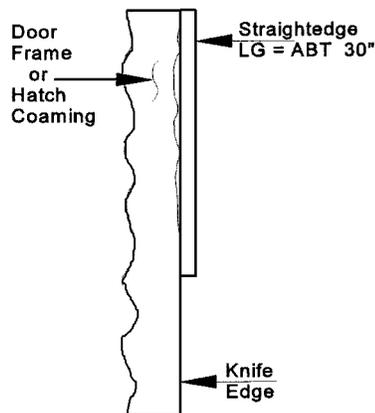


Figure 2-1. Knife-Edge Inspection Using Straightedge Method

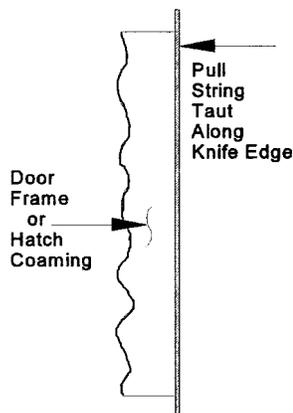


Figure 2-2. Knife-Edge Inspection Using String Method

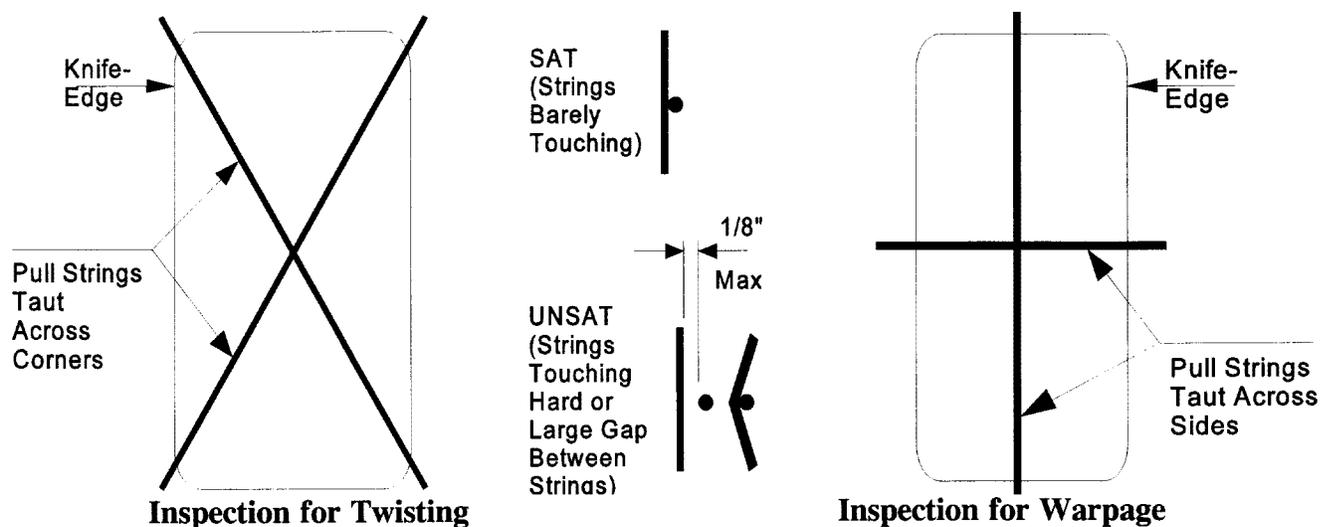


Figure 2-3. Knife-Edge Inspection for Warpage

- b. Inspect the knife-edge for paint, dirt, rust, or nicks. Remove paint and rust with #320 grit aluminum oxide abrasive cloth. Be sure to remove the abrasive grit with a clean rag to prevent the grit from getting embedded in the gasket.

### CAUTION

**A knife-edge that is too high will damage the gasket; a knife-edge that is too low will damage the hinges as a result of overadjusting the door in attempting to maintain a watertight seal.**

- c. Inspect the entire knife-edge for proper height. A block of aluminum cut to the specifications shown in [figure 2-4](#) is an effective gauge. If the knife-edge is more than 1/8 inch too high or too short, it must be repaired in accordance with [step d](#).
- d. Repair a nicked or short knife-edge by building up the area with CRES stainless steel electrode and filing with a flat file. Grind a high steel knife-edge to shorten to the required height. (The use of power grinders on knife-edges is not recommended.) Straighten bent knife-edges by reshaping with a hammer or by bending.

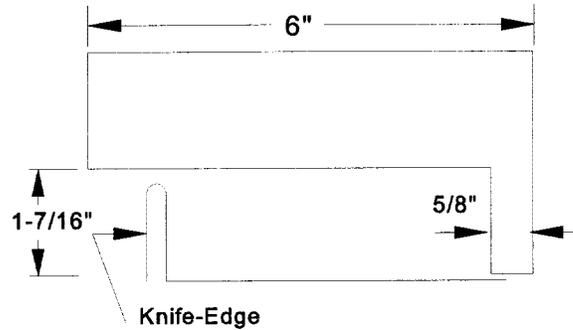


Figure 2-4. Gauge for Measuring Knife-edge Height

2-1.4 GASKET INSPECTION. Rubber gaskets are installed in watertight closures to provide a watertight fit all around by bearing against the knife-edge. Inspect the gasket for the following:

- The rubber must be soft and pliable, and have no cracks.
- There should be no paint, rust, or other foreign matter.
- The gasket joint should be located at the top of the door.
- There must be no gaps in the gasket joint. Replace the gasket if shrinkage has caused separation where the two ends join.
- A permanent set or groove in the rubber may not be greater than 1/8-inch deep.

### CAUTION

**During installation of new gasket, no splices are allowed. Gasket should be one continuous length.**

Replace the gasket if any of these problems exist. If the gasket is otherwise satisfactory, remove any paint from the gasket surface with a small block of hard wood. Remove dirt from the gasket with a clean rag. Damaged gaskets must be completely replaced. See figure 2-5.

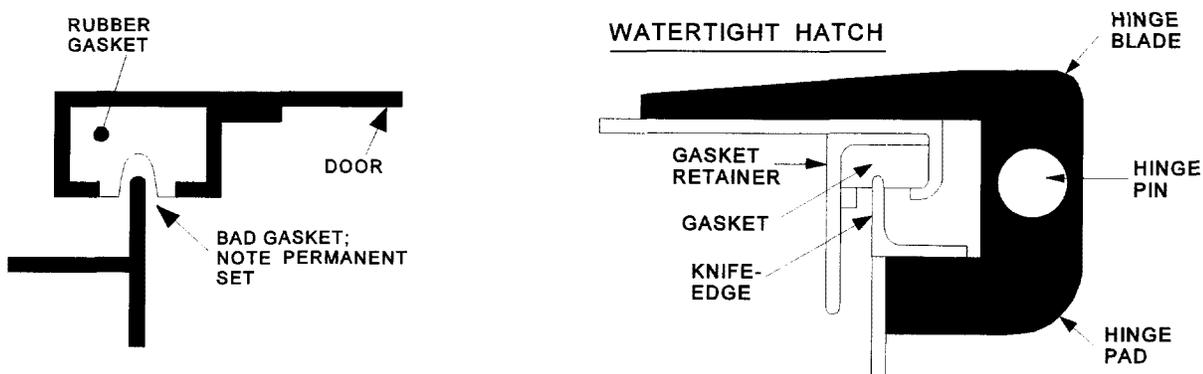


Figure 2-5. Gasket Inspection

2-1.5 CHALK TEST. The chalk test is a simple means of determining if the gasket is in continuous contact with the knife-edge when a closure is dogged. A successful chalk test does not guarantee that a closure is watertight, but, if the gasket is in good condition and dogs are properly adjusted, this test does provide a reasonable

assurance of watertight integrity. To chalk test doors, hatches, and scuttles, accomplish [paragraph 2-1.5.1](#). To chalk test navy standard raised watertight hatches equipped with "drop bolt" type dogs, accomplish [paragraph 2-1.5.2](#).

#### 2-1.5.1 Chalk Test for Doors, Hatches, and Scuttles.

- a. Wipe the knife-edge clean with a dry rag.
- b. Wipe the gasket clean with a dry rag.
- c. Rub chalk on the knife-edge.
- d. Close and dog the closure tightly.
- e. While the closure is dogged down, inspect for any loose dogs. If any dog is loose, adjust the dog and repeat the chalk test.
- f. Open the closure and observe the imprint of chalk on the gasket. The chalk imprint should be in the center three-fifths of the width of the gasket. If the chalk line is not continuous, the closure is not watertight and requires further adjustment or repair. If the chalk imprint has a gap near a dog, the dog may be loose or out of adjustment. However, this also may indicate that the opposite dog is too tight, causing a "bind" in the door. Refer to [paragraph 2-1.9](#) for adjusting the dogs to get a consistent seal around the closure.

#### 2-1.5.2 Chalk Test for Navy Standard Raised Watertight Hatches Equipped With "Drop Bolt" Type Dogs.

- a. Wipe the knife-edge clean with a dry rag.
- b. Wipe the gasket clean with a dry rag.
- c. Rub chalk on the knife-edge.
- d. Carefully lower the hatch using the hand grabs provided on the top of the hatch cover. Do not allow the hatch cover to free-fall. Swing the drop bolts up and through the slot on the dog lugs. Handtighten each dog nut until seated firmly against the dog lug. After all dog nuts have been handtightened, tighten each dog nut down one full turn with the dog wrench to compress the gasket 1/8 inch. (The drop bolt threads are 3/4-8 acme.)
- e. Open the hatch and observe the imprint of chalk on the gasket. If the chalk line is not continuous, the hatch is not watertight and requires further adjustment or repair.

2-1.6 INSPECTION OF WATERTIGHT DOORS. The following inspection procedure applies to both quick-acting and individually dogged doors.

- a. Examine the knife-edge and gasket as described in [paragraph 2-1.3](#) and [paragraph 2-1.4](#).
- b. Accomplish the chalk test as described in [paragraph 2-1.5](#).
- c. Visually inspect the door for missing, damaged, or nonstandard components.
- d. Visually inspect the hinge sleeves and hinge pins (on doors without Machinery Alteration (MACHALT) 167-31006 Engineering Change Proposal (ECP) 518 installed) for wear. Visually inspect the hinge pad bushings, hinge yoke bushings, spacer bushing, and hinge pin (on doors with MACHALT 167-31006 (ECP-518) installed) for wear. With the door opened, grasp the door from the hand lever side and push it toward the hinged side. The door should not give more than approximately 3/16 inch. If it does, either the hinge pins and/or washers are worn, or the holes for the hinge pins have become enlarged. Do not confuse hinge pin

wear with normal play in the hinge blades. Another indication of hinge pin wear is if the metal channel surrounding the gasket on the door side is rubbing against the knife-edge, or if the door panel rubs one or more side dogs when opening or closing. (See figure 2-6, "A.") A good hinge and alignment are illustrated in figure 2-6, "B." Replace the hinge pin washers and/or pins (on doors without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) installed), or replace the hinge pad bushings, hinge yoke assembly, thrust washers, yoke pin spacer, and hinge pin (on doors with MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) installed), if any of the following conditions exist:

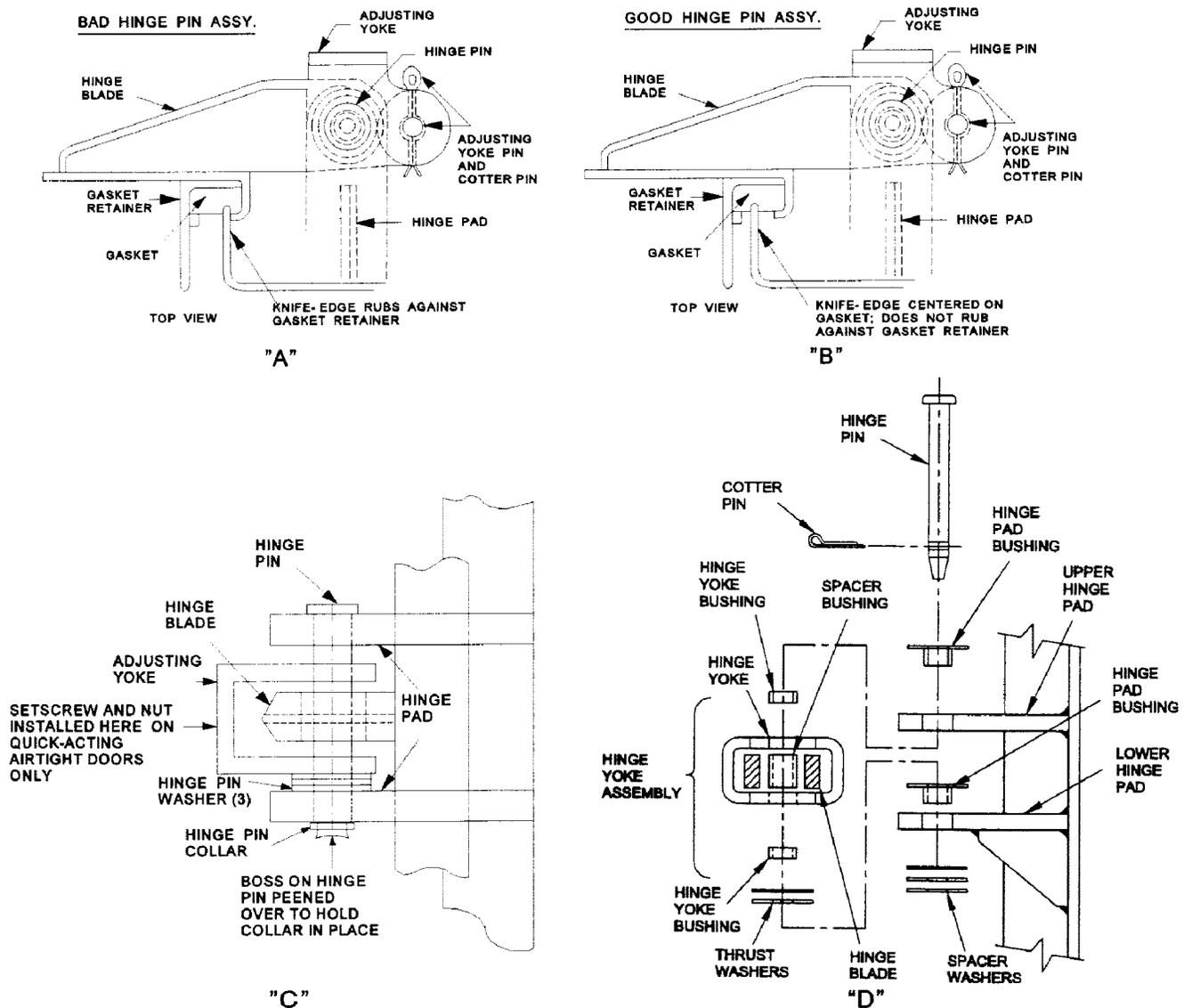


Figure 2-6. Hinge Pin Assemblies

1. The metal surrounding the top and bottom of the door gasket rubs against the knife-edge.
2. The door panel rubs one or more dogs, particularly at the bottom of the door.
3. The door chafes the knife-edge when opened and closed.
4. The hinge pin washers (on doors without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) installed) are worn thin to approximately 1/32 inch. New washers are 1/16 inch in thickness. See figure 2-6, "C." The thrust washers or the flange on the hinge pad bushings (on doors without

MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) installed) are worn thin to approximately 1/32 inch. New thrust washers and the flange on new hinge pad bushings are 1/16 inch in thickness. See [figure 2-6](#), "D."

5. The hinge pin is bent or damaged. Refer to [chapter 3, paragraph 3-1.9](#), for procedures to repair hinge pin assemblies.
- e. Ensure the device for holding the door open is intact and workable.
- f. Inspect the bottom of the door for rust, which would indicate poor cleaning and priming of the coaming.
- g. Inspect each dog assembly. Ensure that the straight bushing is firmly seated against the back of the dog and is free of dirt, rust, and paint. Ensure the flanged bushing is firmly seated against the end of the dog sleeve and is secured in place by its dog point setscrew. See [figure 2-7](#). Setscrews are often painted over and may be difficult to locate. Remove paint as necessary to inspect for loose, missing, or broken setscrews. For self-lubricated bushings, a CRES thrust washer should be installed between the dog lever and the face of the flanged bushing. See [figure 2-7A](#).

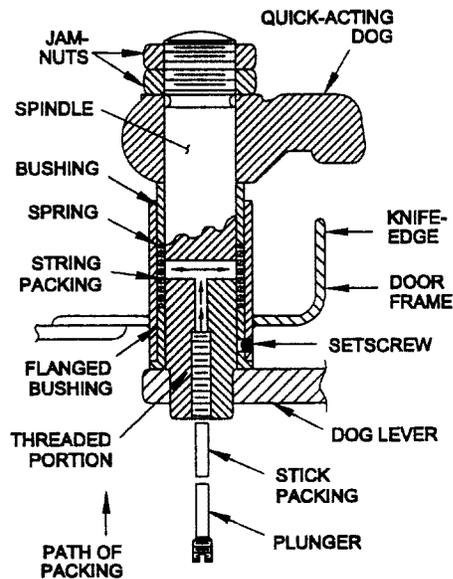


Figure 2-7. Quick-Acting Door Dog Assembly (Cross Sectional View)

- h. With the door opened, the dogs properly adjusted, and the jamnuts tightened, grasp each dog spindle and attempt to shake it up and down and side to side. If it moves, the bushings must be replaced. If the bushings are replaced and there is still visible play between the spindle sleeve in the door frame and the outside of the bushings, the spindle sleeve is corroded to oversized dimensions. In this situation, the entire door should be replaced. This is a common occurrence if the door has not been lubricated and packed in accordance with proper Planned Maintenance System (PMS) instructions, and on weatherdeck doors that are severely corroded.

#### NOTE

Stick packing is not required for doors with self-lubricated bushings installed.

- i. Ensure both jamnuts or self-locking hex nuts are in place on each dog assembly. Jamnuts should be locked tightly together. Remove any paint or dirt from the bushings with a wire brush and a clean rag. The straight bushing should not be stuck in the spindle sleeve and should rest against the back of the dog. If the bushing

is jammed or stuck in the sleeve, it will have to be removed, and the interior of the sleeve cleaned out and lubricated, to ensure a free sliding fit of the bushing in the spindle sleeve. See [figure 2-7](#), [figure 2-7A](#), and [figure 2-7B](#).

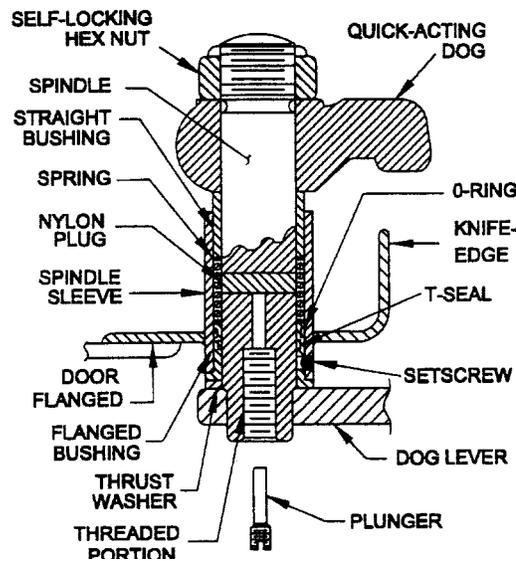


Figure 2-7A. Quick-Acting Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004 (ECP-444)

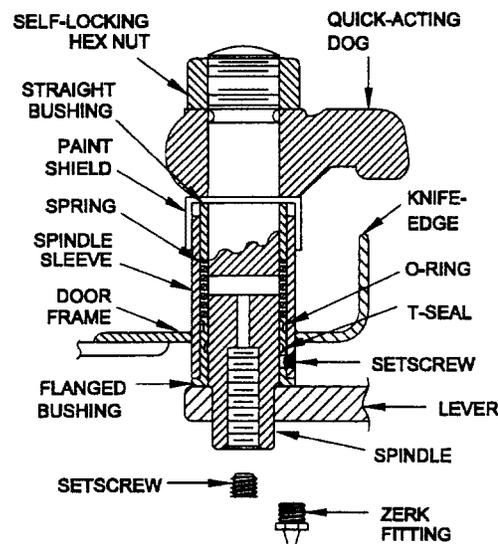


Figure 2-7B. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- j. Ensure there are no missing, broken, or worn spring clips for operating handle. Spring clip shall positively engage operating handle in the undogged position.
- k. Ensure there is no cracked glass in fixed light.
- l. Ensure proper operation of dead light cover over fixed light.

- m. Ensure proper operation and condition of door hook and bumper assembly. Verify there are no parts missing and no structural damage.
- n. Ensure proper material for proper hardware on weather deck doors. Dogs, dog spindle nuts, and operating handles should be CRES (nonmagnetic). Verify with magnet.
- o. Ensure there are no obstructions in way of access to closure. Door should be able to swing open a minimum of 90 degrees. Dogs should not chafe panel edges when opening or closing.
- p. On all weather and well deck doors, remove gasket and inspect gasket channel for loose paint, rust, or corrosion, particularly along the bottom of door.
- q. Accomplish a random inspection of at least two dog sleeves, including at least one from a lower corner dog. Remove double jamnuts or self-locking hex nut, the dog, and the straight bushing. Inspect for the presence of string and stick packing (oilite bushings only), moisture, or rust. If found, inspect all remaining dogs. Replenish string and stick packing, if necessary.
- r. If binding is present, remove paint from wedge pad contact surfaces, dogs, spindle threads, spindle nuts, bushings, packing plungers, setscrews, connecting rod studs and nuts, and contact surfaces of connecting rod linkages using wire brush, scraper, or abrasive cloth. DO NOT REPAINT.
- s. On all weather and well deck doors, ensure gasket is firmly seated in the gasket channel with no bulges, particularly along the bottom of the door.

#### 2-1.6.1 Inspection of Handles.

- a. Quick-Acting Doors. Work the operating handle back and forth to inspect for excessive tightness or binding. A handle which cannot be opened and closed with one hand may have dogs which are out of adjustment or handle nuts which are too tight. If the door handle must be raised in order to close the door, either the hinge pins are worn or the hinge pin bracket holes have become enlarged. If a door will not operate from the inside, either the handle has fallen on the opposite side or the handle is slipping on its spindle. Slipping of the handle indicates excessive wear on the flats of the spindle where they fit into the hole on the end of the handle. Inspect the lineup of the outer and inner handles. If obstructing the free operation of the door, the handles must be disassembled and repaired.
- b. Individually Dogged Doors. Work each individual handle back and forth. The handles should work smoothly. If the handles do not work smoothly, disassemble, clean, and lubricate, then reassemble and adjust in accordance with [paragraph 2-1.9](#). String and stick packing are not required for doors with self-lubricated bushings installed. Refer to [chapter 3, paragraph 3-1.6](#) through [paragraph 3-1.8](#), for procedures on disassembling and repairing handles.

2-1.6.2 Inspection of Dog Wedges. Inspect each dog wedge for wear. If a wedge is worn more than halfway down, or if deep grooves are carved into it, the wedge must be replaced. When setting the door handle on an individually dogged door, the dog should come to a stop approximately one-half of the distance across the surface of the wedge. The dog should never exceed the stop formed into the trailing end of the wedge. If it does, either the dog is out of adjustment or the wedge is worn away and must be replaced. If the raised land (sometimes called the "telltale") on one side of the wedge is worn, this could be an indication that the hinge pins are worn. This condition results from the fact that as the hinge pins wear, the door tends to shift or tilt away from the hinge side toward the lever side. The dog lugs then tend to contact the raised land, wearing it away as the door is opened and closed. Refer to [chapter 3, paragraph 3-1.10](#), to replace dog wedges. Inspect each dog wedge for tight mounting to the door. Grasp each wedge and try to rattle it back and forth. For riveted wedges, tighten loose rivets with a ball peen hammer and back up bar or hammer. For bolted and riveted wedges, the gasket must be removed to access the machine screws or rivets for tightening or replacement. See [figure 2-8](#).

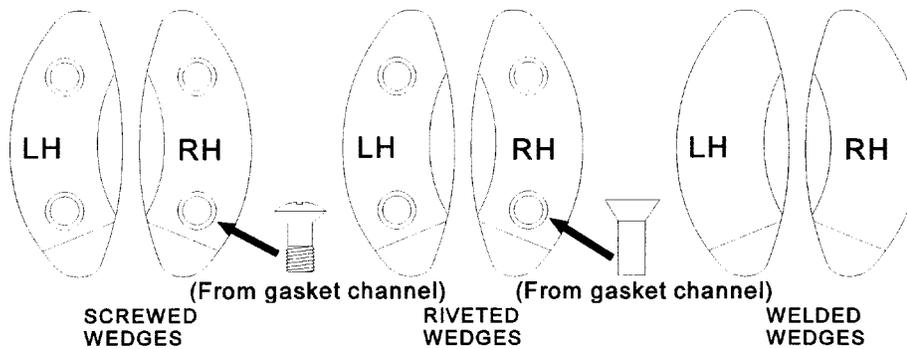


Figure 2-8. Watertight Door Wedges

2-1.6.3 Inspection of Quick-Acting Watertight Door Linkage. Visually ensure all brass conrod collars (round nuts) and cotter pins are in place. With the door open, grasp each connecting rod (conrod) in turn with one hand. Shake the linkage from side to side and note the amount of play. If the linkage is loose or moves more than 1/8 inch, the linkage bushings are worn and must be replaced.

2-1.6.4 Inspection of Quick-Acting Watertight Door Linkage. Inspection of Conrod and Lever Studs. Studs from the factory are swaged in place. Over a period of time, these studs may loosen or break completely away. To inspect for loose studs, open the door and work the hand lever back and forth. Inspect each stud, one at a time. Any studs which move must be repaired by swaging. Refer to [chapter 3, paragraph 3-1.7.3](#), for procedures on repairing studs. Failure of even one stud will cause complete failure of the entire door linkage. See [figure 2-9](#).

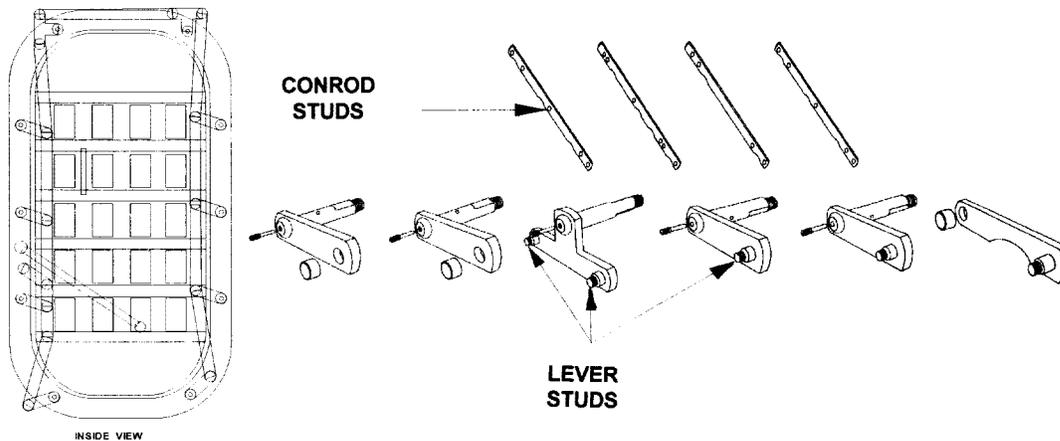


Figure 2-9. Quick-Acting Watertight Door Lever and Connecting Rod Studs

## 2-1.7 INSPECTION OF WATERTIGHT HATCHES.

- a. When inspecting a closed and dogged navy standard raised watertight hatch equipped with "drop bolt" type dogs, which has an orange silicone gasket, standing on the hatch and kicking the dog bolts to ascertain tightness may not be an accurate or consistent method to confirm whether or not the dogs are properly secured. To quickly determine if the dog bolts are secure, start with a visual inspection to ensure all dog bolts are properly engaged on the dog lugs. Grasp each dog nut and attempt to turn the nut by hand. The nuts should not rotate.
- b. Examine the knife-edge and gasket as described in [paragraphs 2-1.3](#) and [2-1.4](#).

- c. Accomplish the chalk test in accordance with [paragraph 2-1.5](#).
- d. With the hatch open, examine the dog bolt threads and nut for wear. Wear is indicated by excessive wobble between the nut and dog bolt. Replace the dog bolt assembly if it is excessively worn. Inspect to ensure that the flats on the dog bolt nut are in good condition and that the dogging wrench fits properly. Replace the nut if the flats are rounded off. Ensure the collar is not missing from the top of the dog bolt. The purpose of the collar is to prevent the loss of the nut when the hatch is opened. If satisfactory, coat the dog bolt threads with a light coating of silicone compound. See [figure 2-10](#).

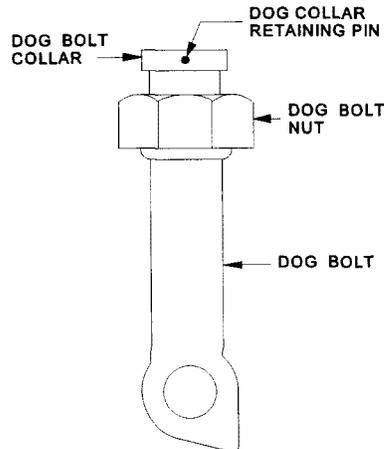


Figure 2-10. Dog Bolt Assembly

- e. All hatches should have a means of holding the hatch cover upright when the compartment below is entered or exited. This consists of a pipe/swivel assembly permanently attached to the hatch cover at one end while the other end is connected by means of a toggle bolt to a clip welded to the hatch coaming. The toggle bolt is fastened to the brace pipe by means of stainless steel aircraft cable to prevent loss. (Do not substitute chain for the cable.) To stow the brace when the hatch cover is closed, the brace pipe is unfastened from the hatch coaming by pulling the toggle bolt from the clip. The brace pipe is then swung up under the hatch cover and fastened with the same toggle bolt to clips that are welded to the hatch underside specifically for this purpose.
  1. Ensure the brace pipe, toggle, and cable assembly are not missing or damaged.
  2. Ensure the pipe assembly supports the hatch cover when in the upright position.
  3. Ensure the toggle bolt is the right size to attach to the clips and that it has not been replaced by nuts and bolts. See [figure 2-11](#).
- f. Hinge pin wear on watertight hatches is often difficult to detect since there is normally a large amount of play in hinges, even when the fitting is new. Thus, it is good practice to periodically remove hinge pins (with hatch closed and dogged) and examine the pins for wear. Ensure washers, lock collars, and cotter pins on hinge pins are in place.

### CAUTION

**When inspecting hinge pins for wear, ensure the space below is unmanned before closing and dogging the hatch.**

- g. The toggle pin on a watertight hatch must be the same size as the hole provided.
- h. For individually dogged hatches, ensure the engineer's wrench is in place. For flush hatches, if the hatch is operated with a T-wrench, ensure the T-wrench is in place.

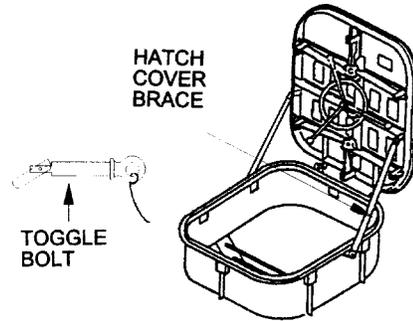


Figure 2-11. Hatch Cover Brace and Toggle Bolt

### 2-1.8 INSPECTION OF WATERTIGHT SCUTTLES.

- a. Examine the knife-edge and gasket as described in [paragraph 2-1.3](#) and [paragraph 2-1.4](#).
- b. Accomplish the chalk test as described in [paragraph 2-1.5](#).
- c. For flush scuttles, ensure the T-wrench is in place.
- d. With the scuttle completely dogged down tight, grasp the handwheel. Play in the handwheel indicates that the wheel nut is loose or the square spindle hole in the handwheel is rounded out. Tighten the nut or replace the handwheel if the square hole is rounded out. If the handwheel nuts are tight and the handwheel can be pulled up and down, the flange formed into the spindle has broken free and the spindle must be replaced. This problem is caused by over tightening (dogging down) the scuttle. See [figure 2-12](#).

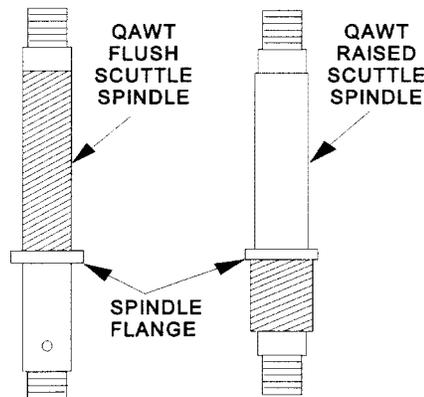


Figure 2-12. Quick-Acting Watertight Scuttle Spindles

Examine the notches formed into the handwheel(s). Turn the wheel to the opened position and feel for the notches. This is a safety requirement which allows opening or closing the fitting by touch in darkness or smoke. Raised watertight scuttles have different handwheels for the upper and lower sides (each with different National Stock Numbers (NSNs)). When replacing the handwheel, be sure to choose the proper replacement part. See [figure 2-13](#).

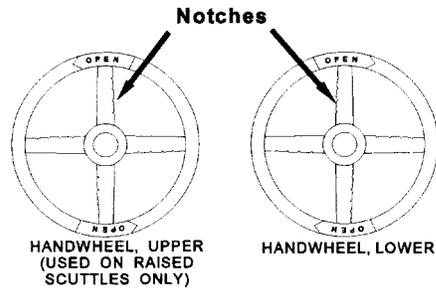


Figure 2-13. Quick-Acting Watertight Scuttle Handwheels

- e. Standing below the scuttle, lower the cover and dog it down. Grasp and attempt to wiggle each dogging arm. If one or more of the dogging arms move, tighten the dog adjustment bolt on the loose arm. Dog adjustment bolts have a locking device that consists of a small nylon plug pressed into a hole in the body of the bolt. The locking device prevents the adjustment bolt from backing out after adjustment of the dogging arm. Inspect each adjustment bolt for wear by trying to tighten it by hand. If the bolt screws in all the way by hand, it is worn and must be replaced. Push each dogging arm in toward the scuttle. If it does not return to position, the spring inside the housing which holds the dog must be replaced. Dogging arm assemblies are the same for raised and flushed scuttles. See [figure 2-14](#).

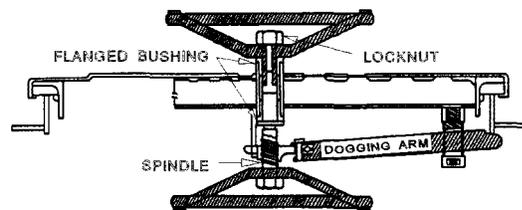


Figure 2-14. Dogging Arm Assembly

- f. Open the scuttle, grasp the handwheel with both hands, and attempt to shake the handwheel from side to side. Any play or movement in the spindle indicates either that the spindle bushings are worn and should be replaced, or that there is not enough silicone compound lubricating the bushings. The handwheel should spin easily when turned. If it does not, the spindle is bound up or seized to the bushings. This is caused by a lack of lubrication between the spindle shaft and bushings. To correct this problem, remove, clean, and reassemble the spindle assembly. If the handwheel wobbles when the nuts are tightened, look down at the spindle while turning the handwheel to determine if the spindle is bent. If the spindle is bent, it must be replaced.
- g. Grasp the spider with both hands, one on each side, and attempt to move it (wobble it) from side to side. A slight movement is normal. However, movement of more than 1/16 inch indicates that the spider and/or the spindle threads are worn and one or both of those parts should be replaced. Also inspect the guide cam for the presence of a correct weld.
- h. Hinge pin wear on quick-acting scuttles is often difficult to detect since there is normally a large amount of play in hinges, even when the fitting is new. Thus, it is good practice to periodically remove and examine the pins to inspect for wear. Ensure that lock collars on hinge pins are in place. For quick-acting flush scuttles, inspect spacer washers for wear.

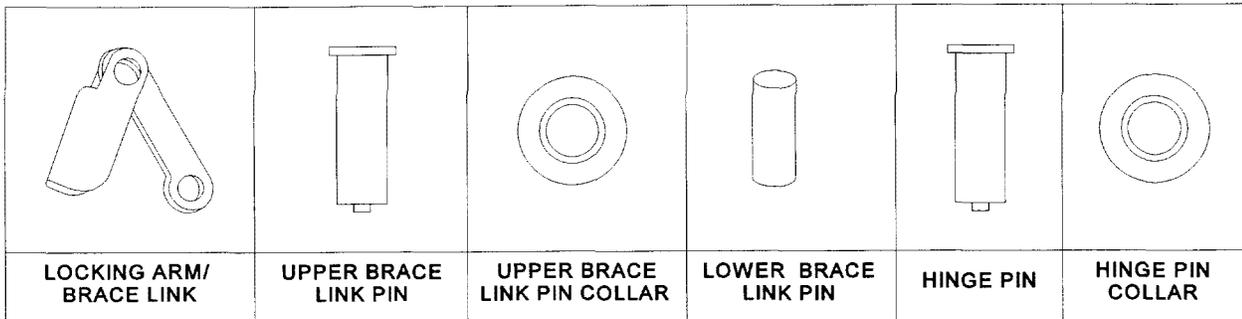
### CAUTION

**Ensure hands are out of the clear opening when conducting this test.**

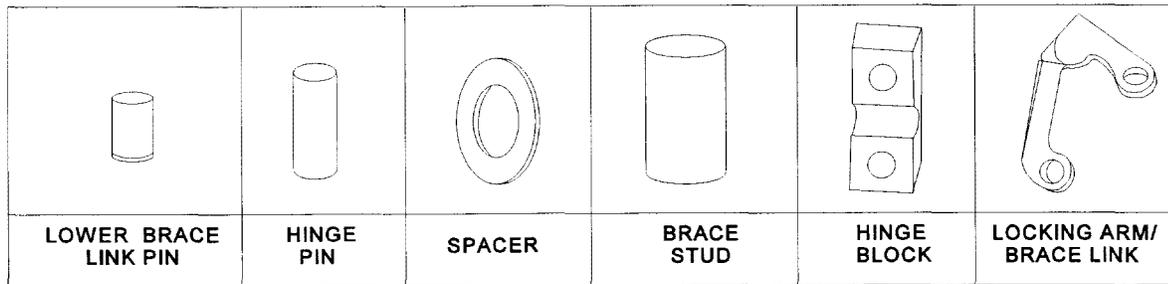
- i. With the scuttle open, push down on the scuttle top. The brace link assembly should not collapse. If the brace

link assembly does collapse, the brace link assembly is worn or bound up from corrosion, and either the brace link assembly or brace link pins should be cleaned and replaced. See [figure 2-15](#).

- j. Clean dirt, debris, and corrosion from around the spindle collar and recessed area around the knife-edge. Ensure the scuttle is easily operated with a T-wrench. If the wrench slips, either the collar slot or T-wrench is worn and should be replaced. Also ensure that drain channels are clear.



**BRACE LINK ASSEMBLY FOR  
QUICK-ACTING WATERTIGHT RAISED SCUTTLE**



**LOCKING ARM/BRACE LINK ASSEMBLY FOR  
QUICK-ACTING WATERTIGHT FLUSH SCUTTLE**

Figure 2-15. Locking Arm/Brace Link

**2-1.9 WATERTIGHT/AIRTIGHT DOOR DOG AND HINGE ADJUSTMENT.** The door knife-edge must contact the gasket at every point continuously around the door to guarantee a watertight seal. If there are areas where the knife-edge does not contact the gasket, adjust the dogs to apply greater pressure to the door and force the gasket to contact the knife-edge. All inspections, repairs, and other adjustments should be completed before adjusting the dogs. There are two methods of adjusting the dogs to provide a 1/8-inch compression of the gasket. Method 1 (refer to [paragraph 2-1.9.1](#)) has proven to be the most accurate. However, this procedure must be accomplished with the gasket removed. Method 2 (refer to [paragraph 2-1.9.2](#)) is accomplished with the gasket in place. However, this procedure is less accurate, especially if there is warpage between the door panel and the knife-edge. Either method can be used for quick-acting or individually dogged doors.

**2-1.9.1 Adjustment Method 1 (Gasket Removed).** To accomplish this procedure, obtain a gauge block, 3/8-inch thick by 1/2-inch wide, fabricated from 3/8-inch flat bar stock. The gauge block should be approximately 6 inches long.

- a. Loosen all jamnuts or self-locking nuts and hinge adjusting screws (airtight doors only).
- b. Remove the existing gasket. If in satisfactory condition, save gasket for reinstallation.
- c. Place the 3/8-inch thick gauge block in the gasket channel directly behind the dog wedge. Using two 1/2-inch long pieces of gasket material, secure the gauge block in the gasket channel.

- d. Close the door and dog door down.
- e. Tighten the first jamnut or self-locking nut down until the knife-edge hits hard against the 3/8-inch thick gauge block. See [figure 2-16](#).
- f. Where jamnuts are used, tighten the second jamnut securely against the first jamnut.

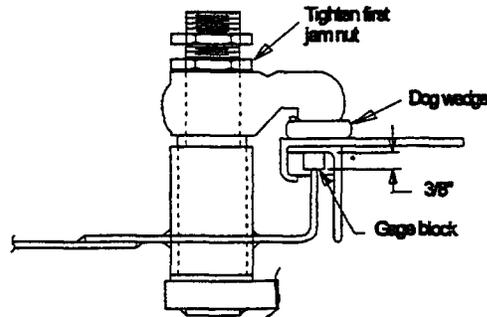


Figure 2-16. Locking Arm/Brace Link

- g. Repeat [step b](#) through [step f](#) for each dog.
- h. For airtight doors, adjust each hinge by inserting the gauge block in the gasket channel directly behind the hinge blade. Close the door, and, using the proper size Allen wrench, tighten the hinge adjusting screw until the knife-edge hits hard against the gauge block. Tighten the hinge adjusting screw locknut firmly against the yoke while holding the adjusting screw with the Allen wrench.

#### 2-1.9.2 Adjustment Method 2 (Gasket Installed).

- a. Loosen all jamnuts or self-locking nuts and hinge adjusting screws (airtight doors only).
- b. Close the door, but do not dog door down.
- c. If there is warpage between the door panel and the frame, the gasket will not contact the knife-edge evenly. Start the dog alignment in the area where the gasket first contacts the knife-edge.
- d. Insert a strip of paper between the gasket and the knife-edge, and dog the door.
- e. Tighten the first jamnut or self-locking nut down until the paper cannot be pulled out from between the knife-edge and the gasket. Ensure the dog is contacting the dog wedge. (For individually dogged doors, two persons are required, one on either side of the door.)
- f. Tighten the first jamnut or self-locking nut an additional 1-1/8 turns to achieve a 1/8-inch gasket compression.
- g. Where jamnuts are used, tighten the second jamnut securely against the first as previously discussed in [paragraph 2-1.9.1, step f](#).
- h. Repeat [step b](#) through [step g](#) for the remaining dogs.
- i. For airtight doors, adjust each hinge by inserting a strip of paper between the gasket and knife-edge behind each hinge and dog the door. Tighten each hinge adjusting screw until the paper can not be slid out from between the knife-edge and the gasket.
- j. For airtight doors, tighten each hinge adjusting screw an additional 1-3/8 turns to achieve a 1/8-inch gasket compression. When finished, tighten the hinge adjusting screw locknut firmly against the yoke while holding the adjusting screw with the Allen wrench.

### 2-1.9.3 Other Door Maintenance.

- a. After adjusting the dogs and/or hinges, accomplish a chalk test inspection. (Refer to [paragraph 2-1.5.](#)) If the door is properly adjusted, the gasket will show a continuous line of chalk.
- b. Once maintenance actions are complete, open and close the door several times to distribute the silicone compound on wearing parts evenly and to confirm that the door is operating satisfactorily. These preventive maintenance procedures, accomplished on a regular basis, should keep watertight/ airtight closure problems to a minimum. Discrepancies which cannot be corrected by the cognizant work group must be reported to the appropriate damage control work center for repair. If the discrepancy cannot be repaired by ship's force, or if the repair parts are not available, submit a deferred action/work request for OPNAV 4790.2K. If discrepancies render the door nonfunctional, indicate as such in the ship's closure log.

### 2-1.10 DOG MAINTENANCE.

- a. Grit and other foreign matter may, over a period of time, become embedded in the lubricated moving parts of dogging mechanisms, resulting in damage to working surfaces. Clean old grease and other foreign matter from threaded and exposed working parts. Avoid getting any oil or cleaning solvents on the gasket when cleaning. The standard rubber gasket materials used in watertight closures are excellent for use as a watertight seal, but do not have high resistance to petroleum based products. Oil or petroleum based solvents in continuous contact with closure gaskets will eventually cause gaskets to deteriorate, resulting in loss of watertightness and requiring replacement of gaskets.
- b. Lubricate dog and hand lever spindles. (Refer to [paragraph 2-1.11.](#))
- c. If the closure is equipped with stick packing plungers, screw in the packing plunger several turns to force packing out and around the spindle. If the packing plunger cannot be screwed in, renew the stick packing. (Refer to [paragraph 2-1.12.](#)) Use no more than three sticks of packing in standard length spindle shaft openings.

#### NOTE

Closures equipped with self-lubricated bushings do not need stick packing or string packing.

### 2-1.11 DOG SPINDLE LUBRICATION.

#### NOTE

On exterior or well deck doors equipped with steel sleeves, MACHALT 167-31010 (ECP-526) removes existing Oilite bronze bushings, string and stick packing, packing plungers, and jamnuts. This MACHALT installs sintered bronze bushings impregnated with Elisha Technologies EDC 1270 EPL O-rings, T-seals, helical springs, self-locking hex nuts, and paint shields and fills the void space inside the spindle sleeve with Elisha Technologies EDC 1270 EPL grease. This MACHALT also replaces the self-lubricated bushing components installed by MACHALT 167-31004 (ECP-444).

Occasionally, due to lack of usage or because of paint and extreme environmental conditions, a dogging mechanism or hand lever will freeze in its spindle and refuse to turn. When this occurs, the dog assembly should

be completely disassembled and cleaned. Refer to [chapter 3](#), [chapter 4](#), and [chapter 5](#) for disassembly instructions for doors, hatches, and scuttles, respectively. For doors equipped with Oilite bronze bushings, string, and string packing, after cleaning the dog assembly:

- a. Replace the string packing which is used to fill space between the coils of the compression spring on the dog spindle. String packing is the same type of material used in stick packing, but is enclosed in a cotton thread jacket.

#### NOTE

Do not use string packing or stick packing on a closure that has self-lubricated bushings installed.

- b. Lubricate the shafts by applying a light coat of silicone compound. Inspect threads for damage. If found, chase thread with 7/8-9 UNC2A die nut. Afterwards, remove all metal particles from spindle threads and shaft. Lubricate dog lever conrod bushings (Oilite only) with a few drops of oil (symbol 2190 TEP), as applicable.
- c. Reassemble the dog assembly.

**2-1.12 REPLACEMENT OF STICK PACKING AND PACKING PLUNGERS.** A hollow shaft which runs down the center and out the sides of dog and hand-lever spindles on watertight doors permits the repacking of these fittings without disassembly. On most doors, the lengthwise opening is threaded and equipped with a packing plunger. (See [figure 2-17](#).) As the plunger is screwed in, it forces 1/4-inch by 1-1/4-inch stick packing (which was specifically developed for watertight doors) out and around the spindle, filling the voids between the spindle, its associated fittings, the string packing, and the spindle sleeve. Stick packing is used in conjunction with string packing to provide an air, gas, and watertight seal around the spindle of the dogging mechanism. Each time maintenance is required, the plunger is screwed in until stick packing is squeezed out around the spindle. If the packing has been completely used up, the packing plunger will not screw in any farther. When this occurs, the stick packing must be replenished.

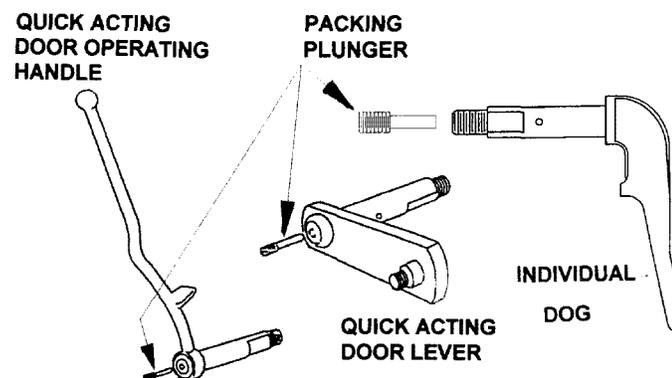


Figure 2-17. Packing Plunger Locations

#### NOTE

Closures equipped with self-lubricated bushings do not need stick packing or string packing. Refer to [paragraph 2-1.13](#) for more information.

- a. To replace stick packing on a closure equipped with packing plungers, accomplish the following:
  1. Stick packing is supplied packed between corrugated cardboard strips. Dip the strip in cold, fresh water

before removing the sticks to prevent the stick packing from adhering to fingers. This precaution ensures that the packing will remain intact when grasp is released.

2. After the packing plunger is removed from the spindle, insert the stick packing into the packing shaft opening.
  3. A 1/4-inch diameter rod is useful for pushing the stick packing deeper into the shaft opening before reinserting the plunger. Push the packing far enough into the shaft so that the plunger does not contact the packing while it is being reinserted. If the plunger comes in contact with the packing before its threads are engaged, some of the stick packing may be wasted.
  4. Reinsert the packing plunger into the packing shaft opening.
  5. Tighten the plunger with a screwdriver until excess packing appears around the spindle. This indicates that all voids inside the spindle sleeve are filled and that the fitting assembly is watertight.
- b. To apply string and stick packing on a closure not equipped with a packing plunger, accomplish the following:
1. On closures that have a spring, slide the dog spindle with the flanged bushing into the frame sleeve and follow it with the compression spring. Wrap approximately 6 inches of string packing around the spindle shaft, between the coils of the spring. Force the string into the frame sleeve by applying pressure to the spring with the straight bushing and final assembly. Finally, use the packing plunger to insert just enough stick packing to form an airtight, gastight, and watertight seal. Avoid putting too much packing in the sleeve. (A maximum of three sticks is usually sufficient.)
  2. On closures without a spring, such as earlier types with 1-inch spindles, wrap 12 inches of string packing around the spindle and slowly force the packing into the frame with the straight bushing and final assembly. Then, add stick packing as described in [step b.1](#).

**2-1.13 SELF-LUBRICATED BUSHINGS.** Oilite phosphor bronze bushings on dog assemblies can be replaced with self-lubricated stainless steel bushings that are Teflon coated. These bushings have an internal T-seal with an external O-ring to provide a watertight seal. These bushings were authorized for new construction; modified dog-in-frame, quick-acting, and individually dogged watertight doors; and for flush and raised scuttles. Self-lubricated bushings may also be found on other ships as a result of modernization, replacement, authorized ship alteration (SHIPALT), or authorized MACHALT. Ordering information for these bushings is provided in [appendix C, section I](#), of this booklet.

With the installation of self-lubricated bushings, string packing, and stick packing are no longer required for dog assemblies. The packing plunger is still left in place inside the spindle to fill the void that would otherwise result. Grease is not used for installation of self-lubricated bushings; silicone compound is used to make the assembly easier. Refer to [chapter 3, paragraph 3-1.4](#), for installation instructions for these bushings.

**2-1.14 SINTERED BRONZE BUSHINGS WITH ELISHA TECHNOLOGIES EDC 1270 EPL GREASE AND CRES PAINT SHIELD (STEEL DOORS ONLY).** MACHALT 167-31010 (ECP-526), applicable to exterior and well deck doors, and other doors located in high humidity areas, replaces the existing Oilite bushings or self-lubricated bushings with sintered bronze bushings impregnated with Elisha Technologies EDC 1270 grease, CRES helical springs, and self-locking hex nuts. This MACHALT also removes the nylon plug from the spindle (where self-lubricated bushings are installed) and replaces the packing plunger with a setscrew plug. A CRES paint shield is also installed over the external end of the sleeve between the dog and straight bushing. See [figure 2-17A](#) and [figure 2-17B](#). In the absence of a MACHALT installation label plate, the presence of a paint shield on the exterior end of the sleeve indicates that MACHALT 167-31010 (ECP-526) has been installed. The void space inside the sleeve is filled with Elisha Technologies EDC 1270 EPL grease, which is injected through a lubrication fitting temporarily installed in the packing plunger hole. Once lubricated, the lubrication fitting is

removed, and a setscrew plug is inserted in the hole. If left in place, the lubrication fitting will interfere with the movement of the operating linkage on quick-acting doors.

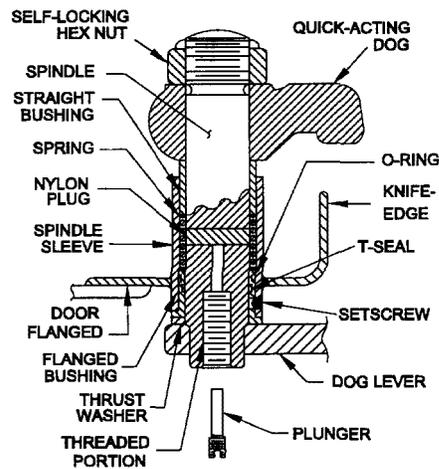


Figure 2-17A. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31004 (ECP-444)

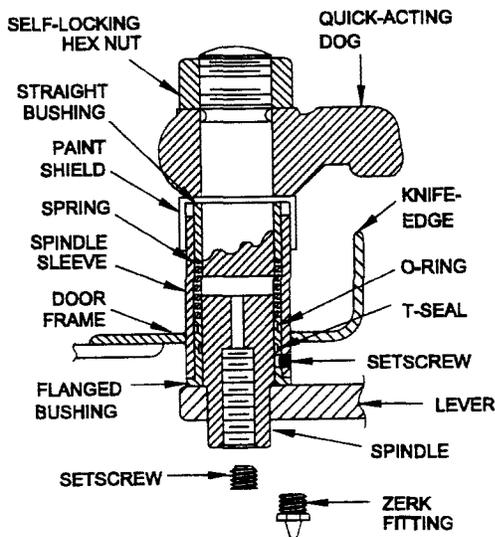


Figure 2-17B. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

### WARNING

**Prior to lubricating this type of dog assembly, ensure all dogs are adjusted for 1/8-inch gasket compression. If dogs are adjusted after lubrication, the grease will be forced out of the sleeve and onto the deck and other parts of the door. Protect deck area below with rags or drop cloth prior to lubrication.**

- a. To lubricate this type of dog assembly, remove the setscrew plug from the packing plunger hole. Install the lubrication fitting. Using a grease gun, inject Elisha Technologies EDC 1270 EPL grease into the sleeve until the grease just starts to flow from the paint shield. Wipe off any excess grease from around the spindle sleeve and paint shield. When complete, remove the lubrication fitting and install the setscrew plug.

2-1.15 GASKET MAINTENANCE AND REPLACEMENT. Clean gaskets by scraping with a hardwood block approximately 5/8-inch wide. You can also use an eraser to clean the gasket. The wooden handle of a wire brush makes an adequate gasket cleaning tool if nothing else is available, provided only the wooden handle is used to clean the gasket.

**WARNING**

**Gasket channels on doors that have radio frequency shielded gaskets (wire impregnated) must be free of paint to ensure proper grounding.**

**CAUTION**

**Under no circumstances should a wire brush or metal scraper be used. Any metal tool can cut or score the rubber.**

**CAUTION**

**Prevent petroleum products from coming into contact with rubber gaskets. These products destroy the gasket material.**

Inspection procedures for watertight closure gaskets are provided in [paragraph 2-1.4](#). If a gasket fails the inspection, accomplish the procedures in [paragraph 2-1.15.1](#) through [paragraph 2-1.15.3](#). Accomplish any dog adjustments before installing a new gasket.

2-1.15.1 Removal.

- a. Locate the gasket joint.
- b. Make a V-shaped cut with a razor knife completely through the gasket on one side of the joint, and remove the wedge of gasket material.
- c. Pull the two ends of the gasket from beneath the channel with a screwdriver, and clamp the ends together with vise grip pliers.
- d. Using the vice grips as a handle, stretch the gasket and pull from the channel around the entire door. See [figure 2-18](#).

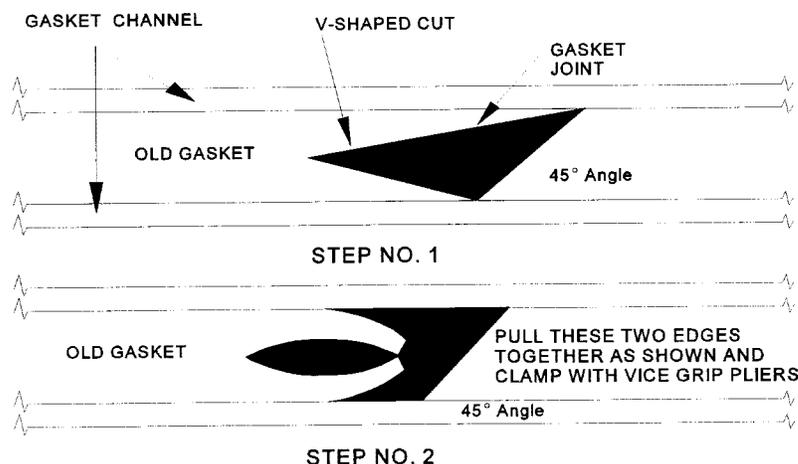


Figure 2-18. Gasket Removal

**WARNING**

**Be careful not to pull on the gasket in a direct line with your face. The pliers could slip and cause injury.**

- e. Clean all debris and corrosion from the inside of the gasket channel. A small rotary wire brush, chucked in an electric drill, is effective for removing this corrosion.
- f. Prime the inside of the gasket channel with Formula 150 epoxy polyamide primer.
- g. When the first coat is dry, apply a topcoat of Formula 151.

#### 2-1.15.2 Installation of MIL-R-900 Gasket Rubber.

**NOTE**

The MIL-R-900 gasket is gradually being phased out for use in nonballistic doors, hatches, and scuttles. This gasket is being replaced by a softer, more resilient, tear resistant, fire retardant, silicone rubber (MACHALT 167-31004 (ECP-444)) in accordance with FEDSPEC ZZ-R-765, Class 3B, Grade 30.

Since a rubber gasket will shrink with age and as a result of the installation procedure, the gasket should be cut several inches longer than the size of the channel. Cut approximately 1 inch extra for every 3 feet of length of channel. Use only a single length of gasket. An overlapping 45-degree angle should be used for the joint.

**CAUTION**

**Do not locate the joint in a radius portion of the closure.**

- a. Installation of Closures Equipped with a C-Type Gasket Channel.

### CAUTION

#### **Do not use any lubricant other than silicone compound.**

1. Use gasket material that has a beveled edge.
  2. Cut a single length of rubber gasket material to go around the door plus 6 inches
  3. Apply silicone compound to the entire gasket and to the inside of the metal gasket channel. Petroleum-based products will deteriorate the rubber gasket. The silicone compound will not only lubricate the rubber but will reduce corrosion by stopping water entrapment in the bottom part of the door.
  4. Begin to install the gasket, with the bevel facing to the inside of the channel. On a door, start at the top center of the closure. With the exception of scuttles, do not place the joint on a curved section of the door or hatch. Gasket joints on scuttles are usually placed at the top of the scuttle when it is open. Clamp one end of the gasket in place with welder's vice grip pliers to keep it from sliding.
  5. To insert the gasket into the channel, use a blunt instrument such as an old, large, flat tipped screwdriver with its tip rounded and smooth. Blunting the tool helps prevent tearing the gasket. A small block of hardwood can also be used. The gasket may be stretched slightly to permit easier insertion of the gasket. After installing approximately 1 foot of gasket, stop and use the blunt tool to apply back pressure to return the gasket to its original shape. (Remove the stretch.) Use additional welder's vice grip pliers, if needed, to hold the gasket in place as the installation proceeds. Repeat this procedure around the door until arrival back at the top. Remove all stretch from the entire gasket.
  6. Let the gasket set for approximately 24 hours to allow for shrinkage.
  7. Trim the excess gasket material to make an overlapping 45-degree joint. Allow a 1-inch overlap to be force fitted into the gasket channel to allow for any further possible shrinkage of the gasket. More than one joint is not permitted on watertight fittings with all radius corners. Joints must be minimized, and splices are not permitted.
  8. Clean any silicone residue from the two mating surfaces of the joint. Apply sealing compound to the gasket joint to prevent leakage. Ensure the joint is tight.
- b. Installation of Closures Equipped with a U-Type Gasket Channel.
1. Cut a single length of rubber gasket material to go around the door plus 6 inches.
  2. Apply sealing compound to the back of the gasket.
  3. Begin to install the gasket. On a door, start at the top center of the closure. With the exception of scuttles, do not place the joint on a curved section of the door or hatch. Gasket joints on scuttles are usually placed at the top of the scuttle when it is open. Clamp one end of the gasket in place with welder's vice grip pliers to keep it from sliding.
  4. To insert the gasket into the channel, use a blunt instrument such as an old, large, flat tipped screwdriver with its tip rounded and smooth. Blunting the tool helps prevent tearing the gasket. A small block of hardwood can also be used. Use additional welder's vice grip pliers, if needed, to hold the gasket in place as the installation proceeds. Repeat this procedure around the door until arrival back at the top. Remove all stretch from the entire gasket.
  5. Trim the excess gasket material to make an overlapping 45-degree joint. Allow approximately 1 inch overlap to be force fitted into the gasket channel to allow for any further possible shrinkage of the gasket. More than one joint is not permitted on watertight fittings with all radius corners. Joints must be minimized, and splices are not permitted.
  6. Ensure the two mating surfaces of the joint are clean. Apply sealing compound to the gasket joint to prevent leakage. Ensure the joint is tight.

---

**WARNING**

---

**All tag-out procedures must be in accordance with current shipboard instructions.**

7. Tag closure "Out of Service." Dog the closure to clamp the gasket in place until the sealing compound sets.

2-1.15.3 Installation of ZZ-R-765 Silicone Gasket (MACHALT 167-31004 (ECP-444)). The ZZ-R-765 Silicone, Class 3B, 30 Durometer, is authorized for all watertight closures except ballistic closures.

---

**CAUTION**

---

**Do not use petroleum-based products on the gasket.**

- a. Cut a single length of silicone gasket material to go around the door plus 1 inch. Ensure both gasket ends are cut square. Apply silicone compound to the gasket.
- b. Begin to install the gasket with the beveled side toward the inside of the channel. On a door, start at the top center of the closure. With the exception of scuttles, do not place the joint on a curved section of the door or hatch. Gasket joints on scuttles are usually placed at the top of the scuttle when open. No tools are required to install a silicone gasket. Simply squeeze the gasket and push into the channel. While installing, apply back pressure to the gasket. Be careful not to stretch the gasket.
- c. When you arrive back at the gasket joint, force fit the extra 1 inch into the channel. More than one joint is not permitted on watertight fittings with all radius corners.
- d. Remove excess silicone compound with a clean rag.

2-1.16 DAMAGE CONTROL CLOSURES INSPECTION FORM. A generic inspection form for use by ship's force to aid in inspecting damage control watertight, airtight, and fumetight closures is provided as [figure 2-19](#). This form is in no way an official inspection guide and is included only as a suggested guide for inspections such as zone inspections. This form serves as a check-off and as documentation of the condition of shipboard closures, and is authorized to be reproduced locally.

2-1.17 MAINTENANCE RECORDS. For any deficiencies that cannot be corrected by ship's force:

- a. Use the Navy's Maintenance and Material Management (3M) System Deferred Action/Work Request Form OPNAV 4790/2K to document the problem.
- b. Provide a Job Sequence Number (JSN) for ordering parts, scheduling future repair, and/or requesting repair by an outside activity.

<b>DAMAGE CONTROL CLOSURES INSPECTION</b> (Ship's Force Personnel Only) U.S.S. _____					
<b>Interior</b>		<b>Location:</b>	<b>Dk:</b>	<b>Name:</b>	
<b>Exterior</b>		<b>Compartment #:</b>	<b>Fr:</b>	<b>Date:</b>	
ITEM	DOOR	HATCH	HATCH WITH SCUTTLE	SCUTTLE	BALLISTIC FITTING
<b>TYPE</b>	WATERTIGHT	AIRTIGHT/FUMETIGHT	QUICK-ACTING	INDIVIDUALLY DOGGED	FLUSH
<b>MATERIAL</b>	STEEL	ALUMINUM	FIBERGLASS/GRP	CRES	HY/HTS
DETAILS	ITEM	FOUND	TYPE OF MOUNTING	CLASSIFICATION	
<b>SIZE</b>	NO. OF DOGS		RAISED	STRUCTURAL (NON-BALLAST)	FIREZONE STRUCTURAL
	TYPE /NO. OF WEDGES		LOW PROFILE	FIREZONE	STRUCTURAL (BALLISTIC)
	LOCATION/NO. OF HINGES		RAMPED LOW PROFILE	COMPANION/ACCESS	SPECIAL
	TEST PRESSURE		FLUSH	STRIKEDOWN	ACCESS
	COAMING		DESIGNATION	PASSING SCUTTLE	
	BEARING/BUSHING				
	DESIGNATION				
INSPECTION	ITEM	CONDITION FOUND		GUIDANCE	
	GENERAL CONDITION				
	OPERATION			Ease of operation, binding	
	STRAIGHTNESS			Bulkhead/deck, closure	
	GASKET			Location of seam, type and condition of gasket	
	FIXED LIGHTS			Size:                      Condition:	
	KNIFE-EDGE			Cracks, kinks, bent, min/max height	
	BUSHINGS/BEARINGS			Freedom of movement	
	FASTENERS			Locknuts/jamnuts, bushings, conrod collars, cotter pins	
	LUBRICANT/ANTISEIZE			Linkage, fasteners	
	COMPONENTS			Spindle, yokes, etc.	
	COAMINGS			Size:                      Condition:	
	ACTUATING MECHANISM			Smoothly operable	
	LINKAGE			Washers between moving parts, lubricated	
	WRENCH/HANDLE/ETC.			Secured and accessible	
	METAL SPRAYED			Weather deck	
	DOG SLEEVES			Deterioration, cracked weld	
	CLOSURE CLEARANCE			Adequate for passage	
	STRUCTURE			Holes, dents, dielectric tape/coating	
	KEEP OPEN LATCH			Scuttle - hatch - door	
	LABEL PLATES			Legible and secure	
	FASTENER MATERIAL			CRES on exterior closures	
	CHANNEL DRAINS			Scuttles/hatches - clogged/unclogged	
<b>REMARKS:</b>					

Figure 2-19. Damage Control Closures Inspection Form

## 2-2. ALUMINUM CLOSURES.

2-2.1 SAFETY. Refer to [paragraph 2-1.1](#).

2-2.2 GENERAL GUIDANCE FOR INSPECTIONS. Refer to [paragraph 2-1.2](#).

### 2-2.3 KNIFE-EDGE AND DOOR FRAME INSPECTION.

- a. Open the fitting. Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. See [figure 2-20](#), [figure 2-21](#), and [figure 2-22](#). The maximum acceptable variation for knife-edge straightness is plus or minus 1/16 inch. The maximum acceptable warpage of the door frame is 1/8 inch. If frame/coaming warpage is excessive, or if the knife-edge straightness is not within tolerances, initiate action to replace the closure.
- b. Inspect the knife-edge for paint, dirt, rust, or nicks. For aluminum knife-edges, remove paint with a nylon scrubbing pad, paint remover and a rag only.

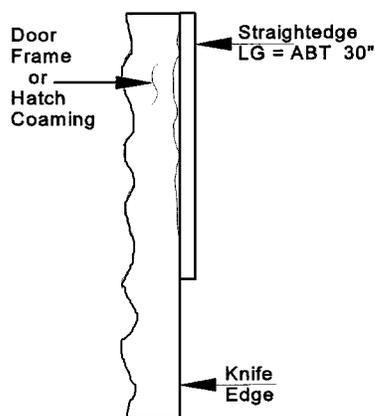


Figure 2-20. Knife-Edge Inspection Using Straightedge Method

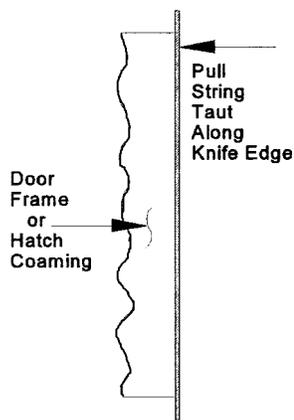


Figure 2-21. Knife-Edge Inspection Using String Method

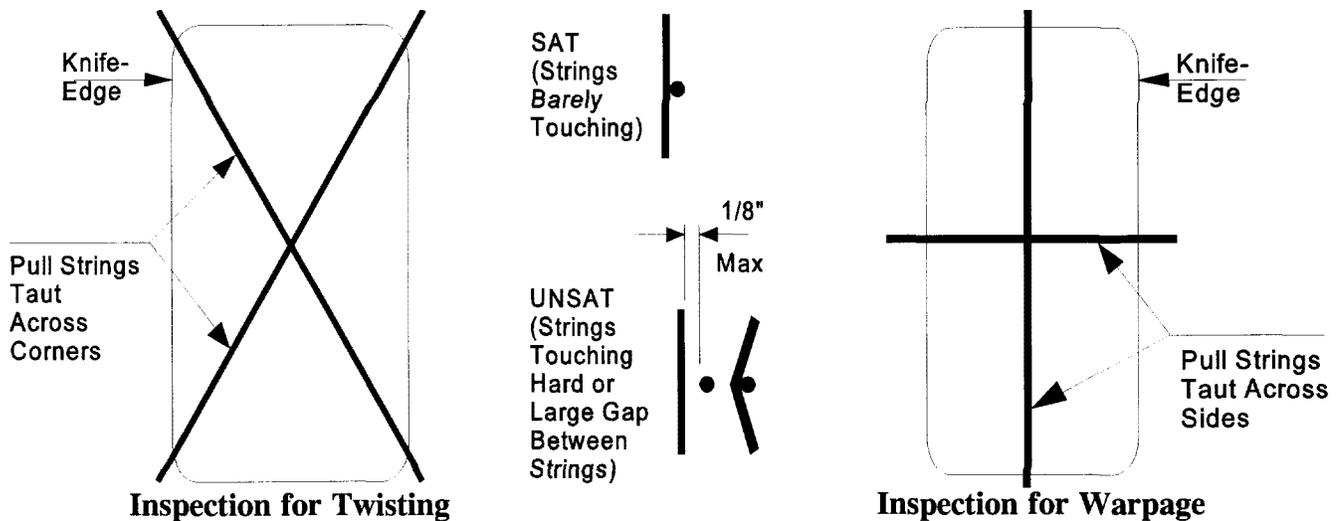


Figure 2-22. Knife-Edge Inspection for Warpage

### CAUTION

**A knife-edge that is too high will damage the gasket; a knife-edge that is too low will damage the hinges as a result of overadjusting the door in attempting to maintain a watertight seal.**

- c. Inspect the entire knife-edge for proper height. A block of aluminum cut to the specifications shown in [figure 2-23](#) is an effective gauge. If the knife-edge is more than 1/8 inch too high or too short, it must be repaired in accordance with [step d](#).
- d. For aluminum knife-edges, do not attempt to build up a short knife-edge. Report the closure to the appropriate damage control work center for the repair. Use only a fine file to file down a high knife-edge, and avoid leaving grooves in the edge. Use a steel striker plate when hammering a bent aluminum knife-edge to avoid denting the aluminum.

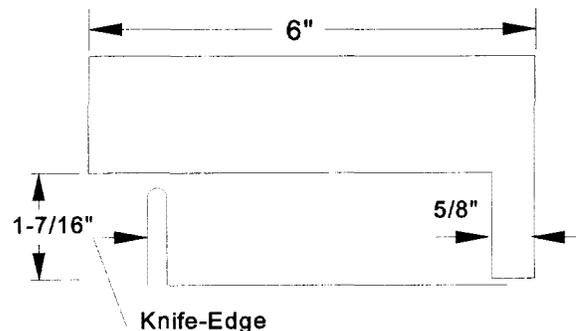


Figure 2-23. Gauge for Measuring

2-2.4 GASKET INSPECTION. Refer to [paragraph 2-1.4](#).

2-2.5 CHALK TEST. Refer to [paragraph 2-1.5](#).

2-2.6 INSPECTION OF WATERTIGHT DOORS. The following inspection steps apply to both quick-acting and individually dogged doors:

- a. Examine the knife-edge and gasket as described in [paragraph 2-2.3](#) and [paragraph 2-1.4](#).
- b. Accomplish the chalk test in accordance with [paragraph 2-1.5](#).
- c. Visually inspect the door for missing, damaged, or nonstandard components.
- d. Visually inspect the hinge sleeves and hinge pins for wear. With the door opened, grasp the door from the hand lever side, and push toward the hinged side. The door should not give more than approximately 3/16 inch. If it does, either the hinge pins and/or washers are worn, or the holes for the hinge pins have become enlarged. Do not confuse hinge pin wear with normal play in the hinge blades. Another indication of hinge pin wear is if the metal channel surrounding the gasket on the door side is rubbing against the knife-edge, or if the door panel rubs one or more side dogs when opening or closing. See [figure 2-24, "A."](#) A good hinge and alignment are illustrated in [figure 2-24, "B."](#) Replace the hinge pin washers and/or pins if any of the following conditions exist:
  1. The metal surrounding the top and bottom of the door gasket rubs against the knife-edge.
  2. The door panel rubs one or more dogs, particularly at the bottom of the door.
  3. The door chafes the knife-edge when opened and closed.
  4. The hinge pin washers are worn thin to approximately 1/32 inch. New washers are 1/16 inch in thickness. See [figure 2-24, "C."](#)
  5. The hinge pin is bent or damaged. Refer to [chapter 3, paragraph 3-1.9](#), for procedures on repairing hinge pin assemblies.
- e. Ensure the device for holding the door open is intact and workable.
- f. Inspect the bottom of the door for corrosion. Corrosion in this location indicates poor cleaning and priming of the coaming.
- g. Inspect each dog assembly. Ensure the straight bushing is firmly seated against the back of the dog and is free of dirt, corrosion, and paint. Ensure the flanged bushing is firmly seated against the end of the dog sleeve and is secured in place by its dog point setscrew. See [figure 2-25](#). Setscrews are often painted over and may be difficult to locate. Remove paint as necessary to inspect for loose, missing, or broken setscrews. For self-lubricated bushings, there should be a CRES thrust washer between the dog lever and the face of the flanged bushing. See [figure 2-25A](#).
- h. With the door open, the dogs properly adjusted, and the jamnuts tightened, grasp each dog spindle and attempt to shake it up and down and side to side. If it moves, the bushings must be replaced. If the bushings are replaced and there is still visible play between the spindle sleeve in the door frame and the outside of the bushings, the spindle sleeve is corroded to oversized dimensions. The entire door should be replaced in this situation. This is a common occurrence if the door has not been lubricated and packed in accordance with proper PMS procedures, and on weatherdeck doors that are severely corroded.

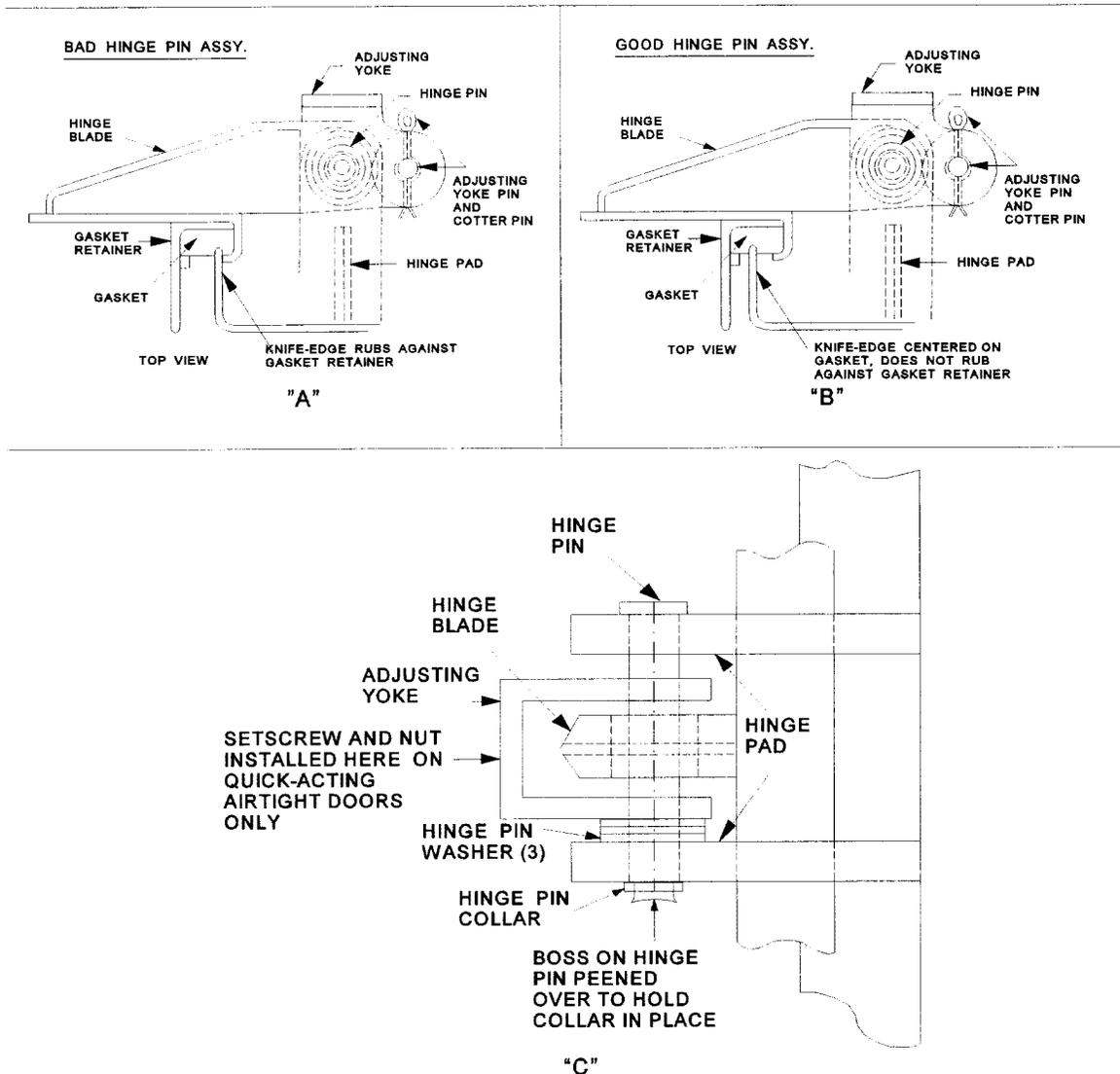


Figure 2-24. Hinge Pin Assemblies

**NOTE**

Stick packing is not required for doors with self-lubricated bushings installed.

- i. Ensure both jamnuts or self-locking hex nuts are in place on each dog assembly. Jamnuts should be locked tightly together. Remove any paint or dirt from the bushings with a wire brush and a clean rag. The straight bushing should not be stuck in the spindle sleeve and should rest against the back of the dog. If the bushing is jammed or stuck in the sleeve, bushing must be removed and the interior of the sleeve cleaned out and lubricated to ensure a free sliding fit. See [figure 2-25A](#).
- j. Ensure there are no missing, broken, or worn spring clips for operating handle. Spring clip shall positively engage operating handle in the undogged position.
- k. Ensure there is no cracked glass in fixed light.

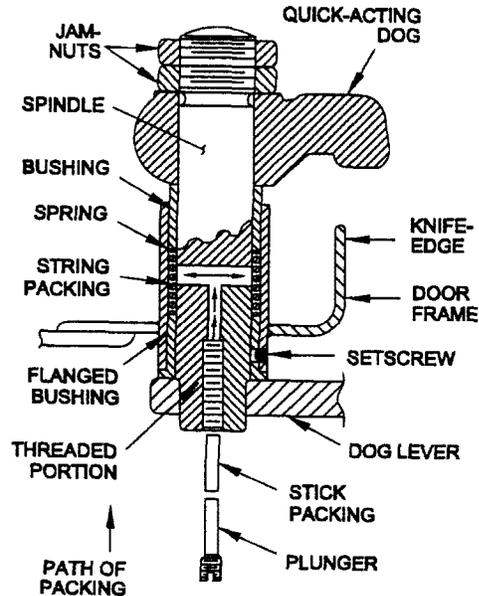


Figure 2-25. Quick-Acting Door Dog Assembly (Cross Sectional View)

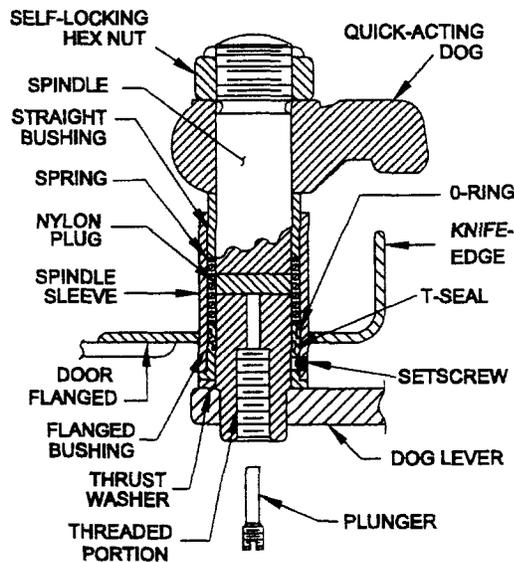


Figure 2-25A. Quick-Acting Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004 (ECP-444)

- l. Ensure proper operation of dead light cover over fixed light.
- m. Ensure proper operation and condition of door hook and bumper assembly. Verify there are no parts missing and no structural damage.
- n. Ensure proper material for proper hardware on weather deck doors. Dogs, dog spindle nuts, and operating handles should be CRES (nonmagnetic). Verify with magnet.
- o. Ensure there are no obstructions in way of access to closure. Door should be able to swing open a minimum of 90 degrees. Dogs should not chafe panel edges when opening or closing.

- p. On all weather and well deck doors, remove gasket and inspect gasket channel for loose paint, rust, or corrosion, particularly along the bottom of door.
- q. Perform a random inspection of at least two dog sleeves, including at least one from a lower corner dog. Remove double jamnuts or self-locking hex nut, the dog, and the straight bushing. Inspect for the presence of string and stick packing (Oilite bushings only), moisture, or rust. If found, inspect all remaining dogs. Replenish string and stick packing, if necessary.
- r. If binding is present, remove paint from wedge pad contact surfaces, dogs, spindle threads, spindle nuts, bushings, packing plungers, setscrews, connecting rod studs and nuts, and contact surfaces of connecting rod linkages using wire brush, scraper, or abrasive cloth. DO NOT REPAINT.
- s. On all weather and well deck doors, ensure gasket is firmly seated in the gasket channel with no bulges, particularly along the bottom of the door.

#### 2-2.6.1 Inspection of Handles.

- a. Quick-Acting Doors. Work the operating handle back and forth to inspect for excessive tightness or binding. A handle which cannot be opened and closed with one hand may have dogs which are out of adjustment or handle nuts which are too tight. If the door handle must be raised in order to close the door, either the hinge pins are worn or the hinge pin bracket holes have become enlarged. If a door will not operate from the inside, either the handle has fallen on the opposite side or the handle is slipping on its spindle. Slipping of the handle indicates excessive wear on the flats of the spindle where they fit into the hole on the end of the handle. Inspect the lineup of the outer and inner handles. If obstructing the free operation of the door, the handles must be disassembled and repaired.
- b. Individually Dogged Doors. Work each individual handle back and forth. The handles should work smoothly. If the handles do not work smoothly, disassemble, clean, and lubricate, then reassemble and adjust in accordance with [paragraph 2-1.9](#). String and stick packing are not required for doors with self-lubricated bushings installed. Refer to [chapter 3, paragraph 3-2.5](#) and [paragraph 3-2.7](#), for procedures on disassembling and repairing handles.

#### 2-2.6.2 Inspection of Dog Wedges. Refer to [paragraph 2-1.6.2](#).

#### 2-2.6.3 Inspection of Quick-Acting Watertight Door Linkage. Refer to [paragraph 2-1.6.3](#).

#### 2-2.6.4 Inspection of Conrod and Lever Studs. Refer to [paragraph 2-1.6.4](#).

### 2-2.7 INSPECTION OF WATERTIGHT HATCHES.

- a. Examine the knife-edge and gasket as described in [paragraph 2-2.3](#) and [paragraph 2-2.4](#).
- b. Accomplish the chalk test in accordance with [paragraph 2-1.5](#).
- c. With the hatch open, examine the dog bolt threads and nut for wear. Wear is indicated by excessive wobble between the nut and dog bolt. Replace the dog bolt assembly if it is excessively worn. Ensure that the flats on the dog bolt nut are in good condition and that the dogging wrench fits it properly. Replace the nut if the flats are rounded off. Ensure that the collar is not missing from the top of the dog bolt. The purpose of the collar is to prevent the loss of the nut when the hatch is opened. If all is satisfactory, coat the dog bolt threads with a light coating of silicone compound. See [figure 2-26](#).

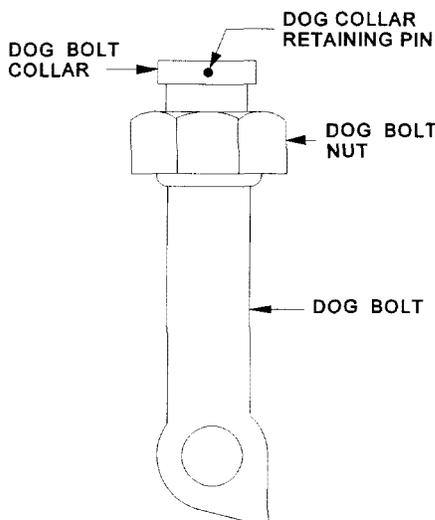


Figure 2-26. Dog Bolt Assembly

- d. All hatches should have a means of holding the hatch cover upright when the compartment below is entered or exited. This consists of a pipe/swivel assembly permanently attached to the hatch cover at one end while the other end is connected by means of a toggle bolt to a clip welded to the hatch coaming. The toggle bolt is fastened to the brace pipe by means of stainless steel aircraft cable to prevent loss. (Do not substitute chain for the cable.) To stow the brace when the hatch cover is closed, the brace pipe is unfastened from the hatch coaming by pulling the toggle bolt from the clip. The brace pipe is then swung up under the hatch cover and fastened with the same toggle bolt to clips that are welded to the hatch underside specifically for this purpose.
1. Ensure the brace pipe, toggle, and cable assembly are not missing or damaged.
  2. Ensure the pipe assembly supports the hatch cover when in the upright position.
  3. Ensure the toggle bolt is the right size to attach to the clips and that it has not been replaced by nuts and bolts. See [figure 2-27](#).

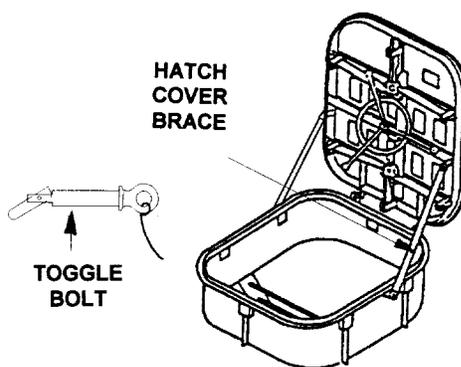


Figure 2-27. Hatch Cover Brace and Toggle Bolt

- e. Hinge pin wear on watertight hatches is often difficult to detect since there is normally a large amount of play in hinges, even when the fitting is new. Thus, it is good practice to periodically remove hinge pins (with hatch closed and dogged) and examine the pins for wear. Ensure washers, lock collars, and cotter pins on hinge pins are in place.

**WARNING**

**Ensure the space below is unmanned before closing and dogging the hatch when checking hinge pins for wear.**

- f. The toggle pin on a watertight hatch must be the same size as the hole provided.
- g. For individually dogged hatches, ensure that the engineer's wrench is in place. For flush hatches, if the hatch is operated with a T-wrench, ensure that the T-wrench is in place.

### 2-2.8 INSPECTION OF WATERTIGHT SCUTTLES.

- a. Examine the knife-edge and gasket as described in [paragraph 2-1.4](#) and [paragraph 2-2.3](#).
- b. Accomplish the chalk test in accordance with [paragraph 2-1.5](#).
- c. For flush scuttles, ensure the T-wrench is in place.
- d. With the scuttle completely dogged down tight, grasp the handwheel. Play in the handwheel indicates that the wheel nut is loose or the square spindle hole in the handwheel itself is rounded out. Tighten the nut or replace the handwheel if the square hole is rounded out. If the handwheel nuts are tight and the handwheel can be pulled up and down, the flange formed into the spindle has broken free and the spindle must be replaced. This problem is caused by overtightening (dogging down) the scuttle. See [figure 2-28](#).

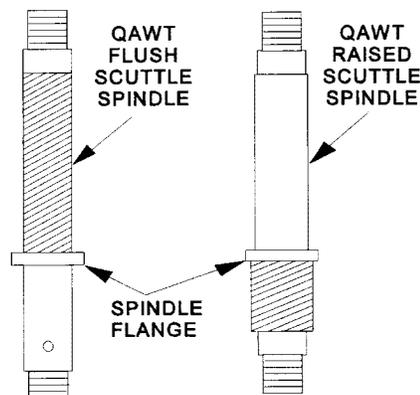


Figure 2-28. Quick-Acting Watertight Scuttle Spindles

Examine the notches formed into the handwheel(s). Turn the wheel to the opened position and feel for the notches. This is a safety requirement which allows opening or closing the fitting by touch in darkness or smoke. Raised watertight scuttles have different handwheels for the upper and lower sides (each with different NSNs). When replacing the handwheel, be sure to choose the proper replacement part. See [figure 2-29](#).

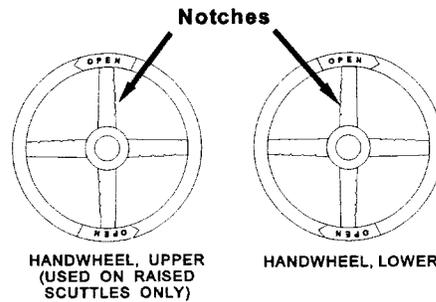


Figure 2-29. Quick-Acting Watertight Scuttle Handwheels

- e. Standing below the scuttle, lower the cover and dog it down. Grasp and attempt to wiggle each dogging arm. If one or more of the dogging arms move, tighten the dog adjustment bolt on the loose arm(s). Dog adjustment bolts have a locking device that consists of a small nylon plug pressed into a hole in the body of the bolt. The locking device prevents the adjustment bolt from backing out after adjustment of the dogging arm. Inspect each adjustment bolt for wear by trying to tighten it by hand. If the bolt screws in all the way by hand, it is worn and must be replaced. Push each dogging arm in toward the scuttle. If it does not return to position, the spring inside the housing which holds the dog must be replaced. Dogging arm assemblies are the same for raised and flushed scuttles. See [figure 2-30](#).

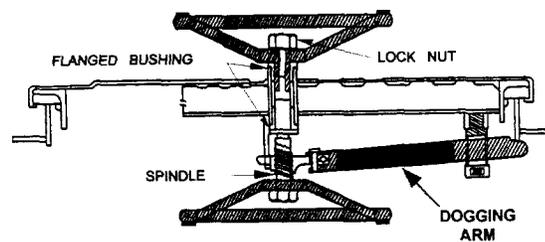


Figure 2-30. Dogging Arm Assembly

- f. Open the scuttle, grasp the handwheel with both hands, and attempt to shake the handwheel from side to side. Any play or movement in the spindle indicates either that the spindle bushings are worn and should be replaced, or that there is not enough silicone compound lubricating the bushings.

The handwheel should spin easily when turned. If it does not, the spindle is bound up or seized to the bushings. This is caused by a lack of lubrication between the spindle shaft and bushings. To correct this problem, remove, clean, and reassemble the spindle assembly.

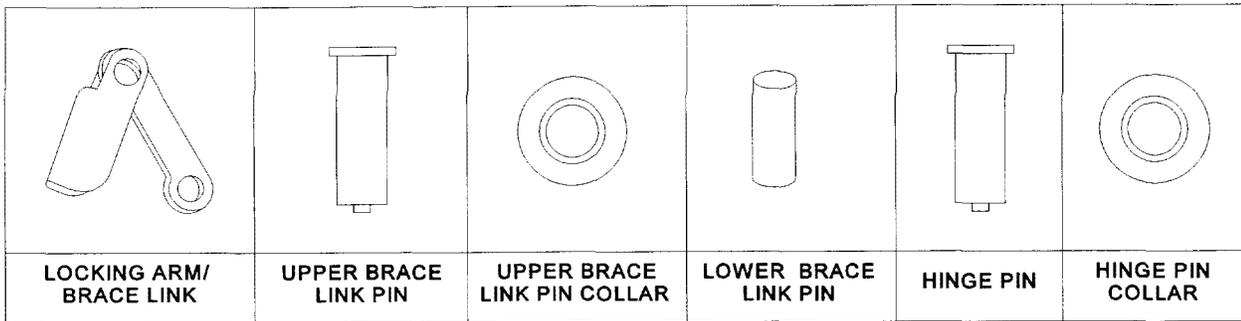
If the handwheel wobbles when the nuts are tightened, inspect the spindle while turning the handwheel to determine if the spindle is bent. If the spindle is bent, it must be replaced.

- g. Grasp the spider with both hands, one on each side, and attempt to move it (wobble it) from side to side. A slight movement is normal. However, movement of more than 1/16 inch indicates that the spider and/or the spindle threads are worn and one or both of those parts should be replaced. Also inspect the guide cam for the presence of a correct weld.
- h. Hinge pin wear on quick-acting scuttles is often difficult to inspect since there is normally a large amount of play in hinges, even when the fitting is new. Thus, it is good practice to periodically remove and examine the pins to inspect for wear. Ensure that lock collars on hinge pins are in place. For quick-acting flush scuttles, inspect spacer washers for wear.

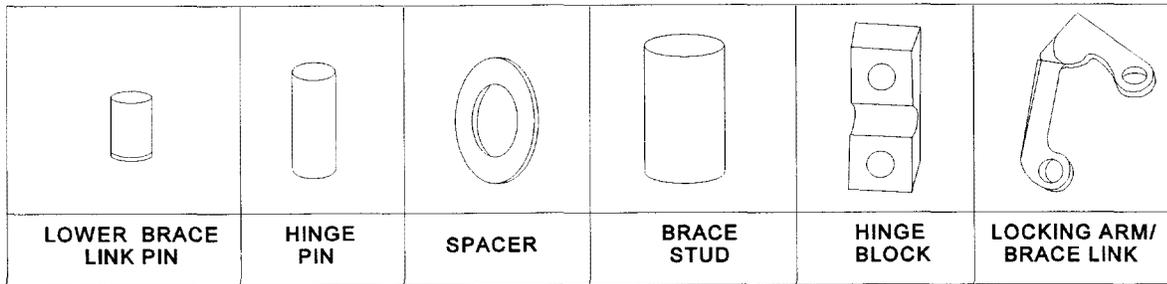
**WARNING**

**Ensure hands are out of the clear opening when conducting this test.**

- i. With the scuttle open, push down on the scuttle top. The brace link assembly should not collapse. If it does, this indicates that the brace link assembly is worn or bound up from corrosion. Either the brace link assembly or brace link pins should be cleaned and replaced. See [figure 2-31](#).



**BRACE LINK ASSEMBLY FOR  
QUICK-ACTING WATERTIGHT RAISED SCUTTLE**



**LOCKING ARM/BRACE LINK ASSEMBLY FOR  
QUICK-ACTING WATERTIGHT FLUSH SCUTTLE**

Figure 2-31. Locking Arm/Brace Link

- j. Clean dirt, debris, and corrosion from around the spindle collar and recessed area around the knife-edge. Ensure the scuttle is easily operated with a T-wrench. If the wrench slips, either the collar slot or T-wrench is worn and should be replaced. Also ensure that drain channels are clear.

2-2.9 WATERTIGHT/AIRTIGHT DOOR DOG AND HINGE ADJUSTMENT. Refer to [paragraph 2-1.9](#).

2-2.9.1 Adjustment Method 1 (Gasket Removed). Refer to [paragraph 2-1.9.1](#).

2-2.9.2 Adjustment Method 2 (Gasket Installed). Refer to [paragraph 2-1.9.2](#).

2-2.9.3 Other Door Maintenance. Refer to [paragraph 2-1.9.3](#).

2-2.10 DOG MAINTENANCE. Refer to [paragraph 2-1.10](#).

2-2.11 DOG SPINDLE LUBRICATION. Refer to [paragraph 2-1.11](#).

2-2.12 REPLACEMENT OF STICK PACKING AND PACKING PLUNGERS. Refer to [paragraph 2-1.12](#).

2-2.13 SELF-LUBRICATED BUSHINGS. Refer to [paragraph 2-1.13](#).

2-2.14 GASKET MAINTENANCE AND REPLACEMENT. Refer to [paragraph 2-1.15](#).

2-2.14.1 Removal. Refer to [paragraph 2-1.15.1](#).

2-2.14.2 Installation of MIL-R-900 Gasket Rubber. Refer to [paragraph 2-1.15.2](#).

2-2.14.3 Installation of ZZ-R-765 Silicone (MACHALT 167-31004 (ECP-444)). Refer to [paragraph 2-1.15.3](#).

2-2.15 DAMAGE CONTROL CLOSURES INSPECTION FORM. Refer to [paragraph 2-1.16](#).

2-2.16 MAINTENANCE RECORDS. Refer to [paragraph 2-1.17](#).

