

NAVAL SHIPS' TECHNICAL MANUAL  
CHAPTER 600  
**STRUCTURAL CLOSURES**

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## CHAPTER 600

### SECTION 1

#### GENERAL INFORMATION

##### 600-1.1 INTRODUCTION.

This chapter is broken up into three volumes. Volume 1 covers structural closures, Volume 2 covers non structural closures, and Volume 3 covers hull fitting equipment. This NSTM is to be used as a guidance document for the equipment and **does not take precedence over equipment-specific technical manuals**, Planned Maintenance Systems (PMS), or ship/standard drawings. Each section provides general safety requirements, purpose, description and types of equipment, inspection, repair, and replacement of the equipment.

##### 600-1.2 Section Breakdown.

The sections covered by this NSTM are as follows:

###### Volume 1 Structural Closures

- Section 1: General Information
- Section 2: Non Ballistic Watertight Doors
- Section 3: Ballistic Doors
- Section 4: Door Latches
- Section 5: Non Ballistic Hatches
- Section 6: Ballistic Hatches
- Section 7: Non Ballistic Scuttles
- Section 8: Ballistic Scuttles
- Section 9: Manhole Covers

###### Volume 2 Non Structural Closures

- Section 10: Introduction
- Section 11: Balanced Joiner Doors
- Section 12: Firezone and Fumetight Doors
- Section 13: Sound Insulated Doors
- Section 14: Non-Tight Joiner Doors
- Section 15: Vent Dampers/Gaylord Hoods

###### Volume 3: Hull Outfitting Equipment

- Section 16: Introduction
- Section 17: Ladders
  - Accommodation Ladders
  - Brows
  - Inclined Ladders
  - Vertical Ladders
  - Pilots Ladders
  - Jacob's Ladders

Side Ladders  
Embarkation Ladders  
Section 18: Personnel Safety Protection  
Climber Safety Rail System  
Liferails, Lifelines, and Guardline Assemblies  
Safety Nets  
Section 19: Miscellaneous Equipment  
Airports and Fixed Portlights  
Windows, Non-Icing, Electrically Heated  
Window Wiper Systems

### 600-1.3 Definition of Terms.

#### Accommodation Ladder

a portable set of steps on a ship's side for the accommodation of people boarding from small boats or from a pier.

#### Airport

a circular opening or window, installed on the ship's side or deckhouse similar to a porthole, through which light or ventilation can pass.

#### Brow

also known as a gangplank, it is a portable bridge or ramp between the ship and a dock, pier, or wharf. Usually fitted with wheels at the shore end.

#### Climber Safety Rail

personnel wearing safety harnesses are connected to a positive safety system fitted to each permanently installed topside ladder on masts, kingposts, and other similar topside structures.

#### Dog

a simple mechanical device used in closing doors, hatch covers, scuttles, and manhole covers.

#### Door

provides a passage between ship compartments through a bulkhead.

#### Door, Airtight

a door so constructed that when closed will prevent air under pressure from passing through. Used on air locks to boiler rooms under forced draft and in similar locations.

#### Door, Firezone

a door so constructed that it provides fire-tight protection from passing through. By definition, a firezone door is also considered to be fume-tight.

#### Door, Fume-tight

a door so constructed that it will prevent the passage of fumes but is not designed to prevent the passage of flames.

#### Door, Joiner

a light door fitted to compartments where airtight and watertight requirements do not exist. Usually made of metal with pressed panels, joiner doors can also be constructed with wood, or metal covered wood, under certain circumstances.

#### Door, Watertight

a door so constructed that when closed will prevent water under pressure from passing through. Used on watertight boundary bulkheads and in similar locations.

#### Guardline Assemblies

portable ready access openings in the rope or chain systems of lifelines or liferails.

#### Hatch

access opening in the deck of the ship, fitted with a four-sided hatch cover for watertight closure.

Heavy Weather Lifelines

portable exterior lifelines fitted with heavy duty netting that enable personnel to safely transverse open decks during impending or actual storm conditions.

Inclined Ladder

a metal ladder with inclined steps and handrails.

Jacob's Ladder

a casual rope ladder with rounded steps for going up and down the sides of the ship, usually for one-time or short term use.

Lifelines

portable safety barriers fitted with netting and installed parallel to edges of decks, openings, and platforms. They must be readily removable for action, exercises or operations.

Liferails

rigid barriers installed along deck edges and platforms. Usually permanently fixed but can be hinged or portable.

Manhole

round or oval hole cut in the deck, bulkhead, or tank top to provide access. Fitted with means for closure when appropriate.

Pilots Ladder

a rope ladder with flat steps used over the side of the ship by pilots when arriving or departing ship via smaller vessel.

Porthole

similar to airport, it is a circular opening or window, installed on the ship's side or deckhouse, through which light or ventilation can pass.

Safety Nets

a fixed or hinged safety system, installed parallel to decks around boundaries in access trunks or hatchways extending through three or more decks or where liferails or lifelines would interfere with deck or aircraft operations.

Scuttle

a circular or oval opening with a similarly shaped cover fitted in decks, bulkheads, or hatches to provide access. When fitted with means whereby the covers can be opened quickly to permit exit, they are called quick-acting scuttles.

Side Ladder

a fixed or flexible vertical ladder for crew to use when boarding the ship from small boats.

Vertical Ladder

a fixed ladder, perpendicular to the deck, that provides access between decks, levels, platforms, and various other applications where space prohibits the use of inclined ladders.

## SECTION 2

### DOORS, NON-BALLISTIC, WATERTIGHT AND AIRTIGHT, STEEL AND ALUMINUM

#### 600-2.1 PURPOSE AND BACKGROUND

600-2.1.1 The closures covered in this section include quick acting and individually dogged, steel and aluminum, watertight and airtight doors. The section will cover inspection, repair and replacement of these types of doors

#### NOTE

This section provides information regarding various types of manually operated watertight doors found on older ships as well as on recently constructed ships. Numerous design changes in watertight closure components have occurred over the years, and NAVSEA Standard/Hull type drawings have been revised to reflect these changes. However, some older ships in the Fleet may not have had their closures upgraded with these various design improvements by SHIPALT, MACHALT, or AER (Alteration Equivalent to Repair) programs. Applicable APLs (Allowance Parts List) have been revised to include these improved components so that closures can be backfitted, as parts require replacement. For information on power operated closures, consult the applicable NAVSEA Technical Manuals for the specific ship class and hull number.

The primary function of watertight doors is to provide access and prevent progressive flooding. Their secondary function is to control the spread of fire, toxic vapors and smoke. Doors, along with hatches, scuffles and manholes, allow movement of personnel throughout the ship. There are approximately twenty different types of watertight closures, each designed with a specific purpose.

600-2.1.2 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 scuffle 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.

#### 600-2.2 DESCRIPTION

600-2.2.1 Quick-Acting Watertight Doors. (See figure 600-2.1). Steel, quick-acting watertight doors are built in accordance with drawing NAVSEA 803-6397268. This drawing, issued April 1988, combined all standard quick-acting watertight door sizes into one drawing, and superseded the following NAVSEA standard drawings for new construction or replacement of existing doors:



NAVSEA 805-1340187  
 NAVSEA 805-1400050  
 NAVSEA 805-1400056  
 NAVSEA 805-1400057  
 NAVSEA 805-1400058  
 NAVSEA 805-1400059  
 NAVSEA 805-1400060  
 NAVSEA 805-1400061  
 NAVSEA 805-1400062  
 NAVSEA 805-1400063  
 NAVSEA 805-1400064  
 NAVSEA 805-1400065  
 NAVSEA 805-1400070  
 NAVSEA 805-1626433  
 NAVSEA 805-1626510

Aluminum quick-acting doors are built in accordance with NAVSEA Drawing 167-7044215.

As there are many existing doors throughout the Fleet built in accordance with the superseded drawings, the drawings still remain active for the purpose of obtaining repair parts for the doors. These doors are used for routine passage and access/egress into the superstructure from the weather decks, main passageways, or manned spaces such as the Combat Information Center (CIC), Radio Central, Machinery Control Central, or Damage Control Central. These doors are usually placed in high traffic areas.

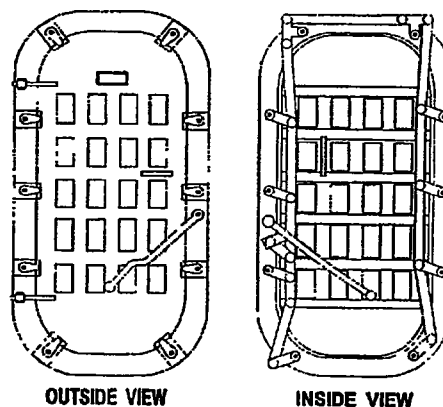


Figure 600-2.1 Quick-Acting Watertight Door

600-2.2.2 Quick-Acting Airtight Doors. (See figure 600-2.2) Quick-acting airtight doors are built in accordance with drawing BUSHIPS 805-1400074. These doors are usually found above the V-lines and are used to access fan rooms, storerooms, and spaces where interior bulkheads are required to be airtight. These doors have three dogs on the handle side and no dogs on the hinge side. They are designed to prevent the spread of fire, toxic vapors, and smoke in case of shipboard casualties. Historically, three dog QA airtight doors have proven to be extremely maintenance intensive, and are gradually being phased out. QA watertight 8-dog doors, as well as QA

airtight 6-dog doors (modified 8-dog doors), are being specified on new construction ships for areas requiring airtight doors, such as interior airlock doors in Collective Protection System (CPS) boundaries, and in structural bulkheads designated as airtight (AT).

For inspection and repair of these airtight doors, follow the procedures for quick acting watertight doors.

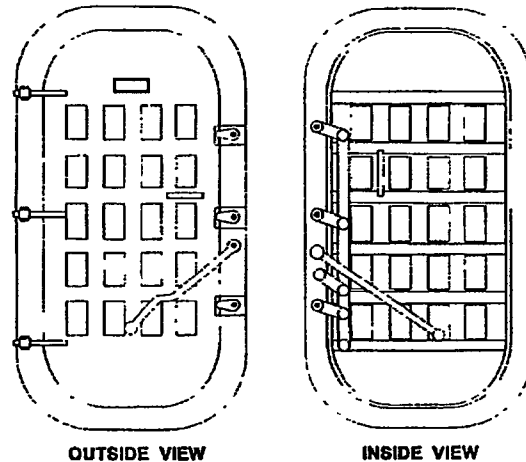


Figure 600-2.2. Quick-Acting Airtight Door

600-2.2.3 Individually Dogged Watertight Doors. (See figure 600-2.3) These doors are either 4-, 6-, 8-, 10-, or 12-dogged and watertight. These doors provide access/egress to compartments that are not high usage spaces and which do not require rapid access such as paint lockers, deck gear lockers, or storerooms. The 10-dog doors are usually found below the V-lines in order to maintain a higher degree of watertight integrity.

Individually dogged steel doors are built in accordance with drawing, NAVSEA 803-6397261. This drawing, issued February 1988, combined all standard individually dogged watertight door sizes into one drawing, and superseded the following NAVSEA standard drawings for new construction or replacement of existing doors:

NAVSEA 805-1400066

NAVSEA 805-1400069

NAVSEA 805-1400070

NAVSEA 805-1400071

NAVSEA 805-1400072

NAVSEA 805-1400073

NAVSEA 805-1623052

NAVSEA 805-1623053

NAVSEA 805-1626357

Aluminum individually dogged doors are built in accordance with NAVSEA drawing 167-7044217.

As there are many existing doors throughout the Fleet built in accordance with the superseded drawings, the drawings still remain active for the purpose of obtaining repair parts for the doors.

These doors have 4, 6, 8, 10, or 12 dogs. They provide access/egress to compartments that are not high usage spaces and that do not require rapid access, such as paint lockers, deck gear lockers or storerooms. Ten dog doors

are usually found below the V-lines to maintain a higher degree of watertight integrity.

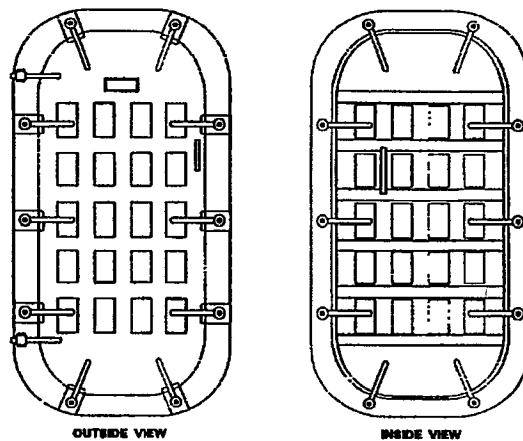


Figure 600-2.3. Individually Dogged Watertight Door

600-2.2.4 Machinery Alterations (MACHALTs) Applicable to Watertight Doors Several MACHALTs have been approved and have been installed on watertight doors. The MACHALTS covered in this NSTM section will be described briefly.

600-2.2.4.1 MACHALT 444 This MACHALT applies to steel watertight doors. The MACHALT replaces the stick packing and plunger in the dog sleeve and installs self lubricating, stainless steel dog sleeve bushings (and for quickacting doors, the dog handle bushing as well) that are Teflon-coated, in addition to a set screw and zerk fitting. This MACHALT also replaces the door gasket material (Mil-R-900) with silicone rubber - ZZ-R-765 - material.

600-2.2.4.2 MACHALT 518 (AOE6 class only) and MACHALT 538 These two MACHALTS replace watertight door hinge assembly hardware on steel watertight doors. Even though the MACHALT is officially for steel quick acting watertight doors only, this MACHALT will also work on steel individually dogged doors as well as aluminum doors that have been built in accordance with the aluminum door AER. The new hinge assemblies have been tested to over 1,000,000 open/close cycles with little wear occurring.

600-2.2.4.3 MACHALT 526 **This MACHALT applies to steel watertight doors only, doors that are either located in exterior locations or in high humidity areas. This MACHALT replaces the stick packing still found on some watertight doors as well as replacing MACHALT 444 which supplied self lubricating bushings. MACHALT 526 consists of new self-lubricating bushings, a lubricant that is pumped into the dog sleeve as well as the addition of a paint shield on the exterior of the dog sleeve, which reduces the amount of debris and moisture that get into the sleeve cavity.**

600-2.2.4.4. MACHALTS 514 and 523 These two MACHALTS, which are both door latch devices, are covered in Section 4. MACHALT 514 is a dog assist latch and is installed only on 3-dog, bound hinge airtight doors. MACHALT 523 is installed on doors of airlocks/pressure locks, which are generally located in boundaries of Collective Protection System zones (CPS).

### 600-2.3 INSPECTION.

600-2.3.1 Overview. This subsection is designed to provide general guidance for inspection. Refer to the MRCs and drawings if applicable for more specific information. Specific repair information is found later in this section under Repair subsection. Damage Control Closures Inspection Forms (Figure 600-2.4) are often used to collect

assessments on closures.

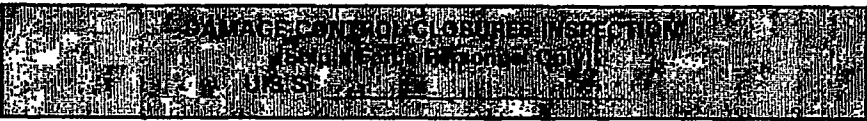


					
				Dk: _____	Name: _____
				Fr: _____	Date: _____
ITEM	DOOR	HATCH	HATCH WITH SCUTTLE	SCUTTLE	BALLISTIC FITTING
TYPE	WATERTIGHT	AIRTIGHT/FUMETIGHT	QUICK-ACTING	INDIVIDUALLY DOGGED	FLUSH
MATERIAL	STEEL	ALUMINUM	FIBERGLASS/GRP	CRES	HY/HTS
DETAILS	ITEM	FOUND	TYPE OF MOUNTING	CLASSIFICATION	
SIZE	NO. OF DOGS		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 600-2.4. Damage Control Closures Inspection Form

## 600-2.3.2 Quick-Acting Doors

600-2.3.2.1 Steel Quick-acting Watertight Doors General Inspection Procedure. The following inspection procedure applies to steel quick-acting doors.

- a. Examine the knife-edge and gasket as described in paragraph 600-2.3.2.3 and paragraph 600-2.3.2.4.
- b. Accomplish the chalk test as described in paragraph 600-2.3.2.5.
- 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 600-2.5, "A") A good hinge and alignment are illustrated in figure 600-2.5, "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:
  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 600-2.5, "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 600-2.5, "D".

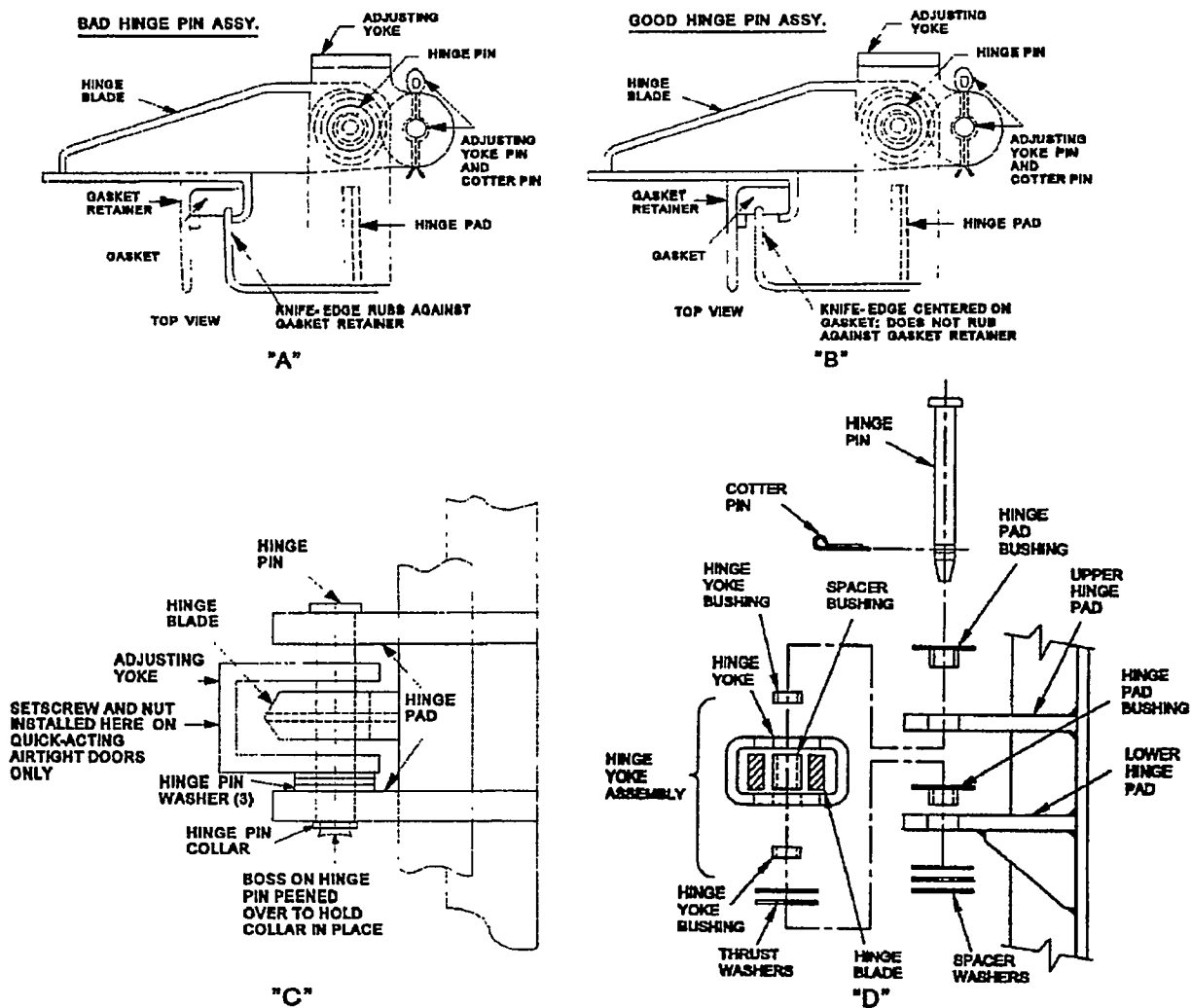


Figure 600-2.5. Hinge Pin Assemblies

5. The hinge pin is bent or damaged. Refer to paragraph [600-2.4.2.8](#) 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 [600-2.6](#). 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 [600-2.7](#).

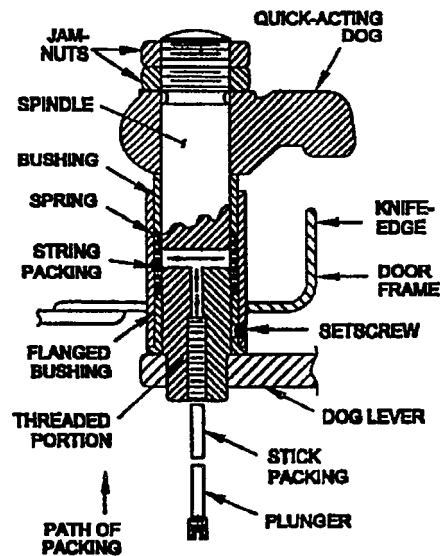


Figure 600-2.6. Quick-Acting Door Dog Assembly (Cross Sectional View)

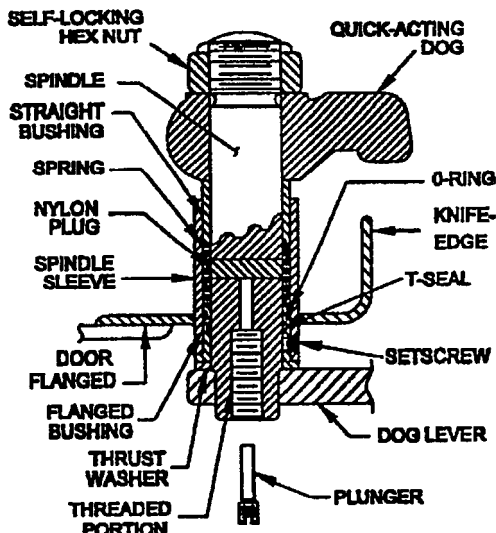


Figure 600-2.7. Quick-Acting Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004(ECP-444)

- 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. 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 600-2.6, figure 600-2.7, and figure 600-2.8.

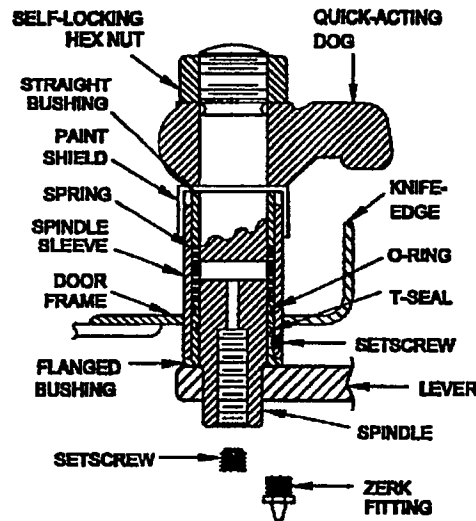


Figure 600-2.8. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- 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.
- t. Verify there are no missing, loose, or worn dog wedges. Mechanically fastened wedges should be tight with



no movement allowed. A wedge is worn out when it has worn to less than half its original thickness of 5/16" on the flat portion of the wedge or if the leading edge of the taper is 1/16" or less.

600-2.3.2.2 Aluminum Quick-acting Watertight Door General Inspection Procedures: The following inspection steps apply to aluminum quick-acting doors:

- a. Examine the knife-edge and gasket as described in paragraph 600-2.3.2.3 and paragraph 600-2.3.2.4.
- b. Accomplish the chalk test in accordance with paragraph 600-2.3.2.5.
- 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 600-2.9, "A". A good hinge and alignment are illustrated in figure 600-2.9, "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.

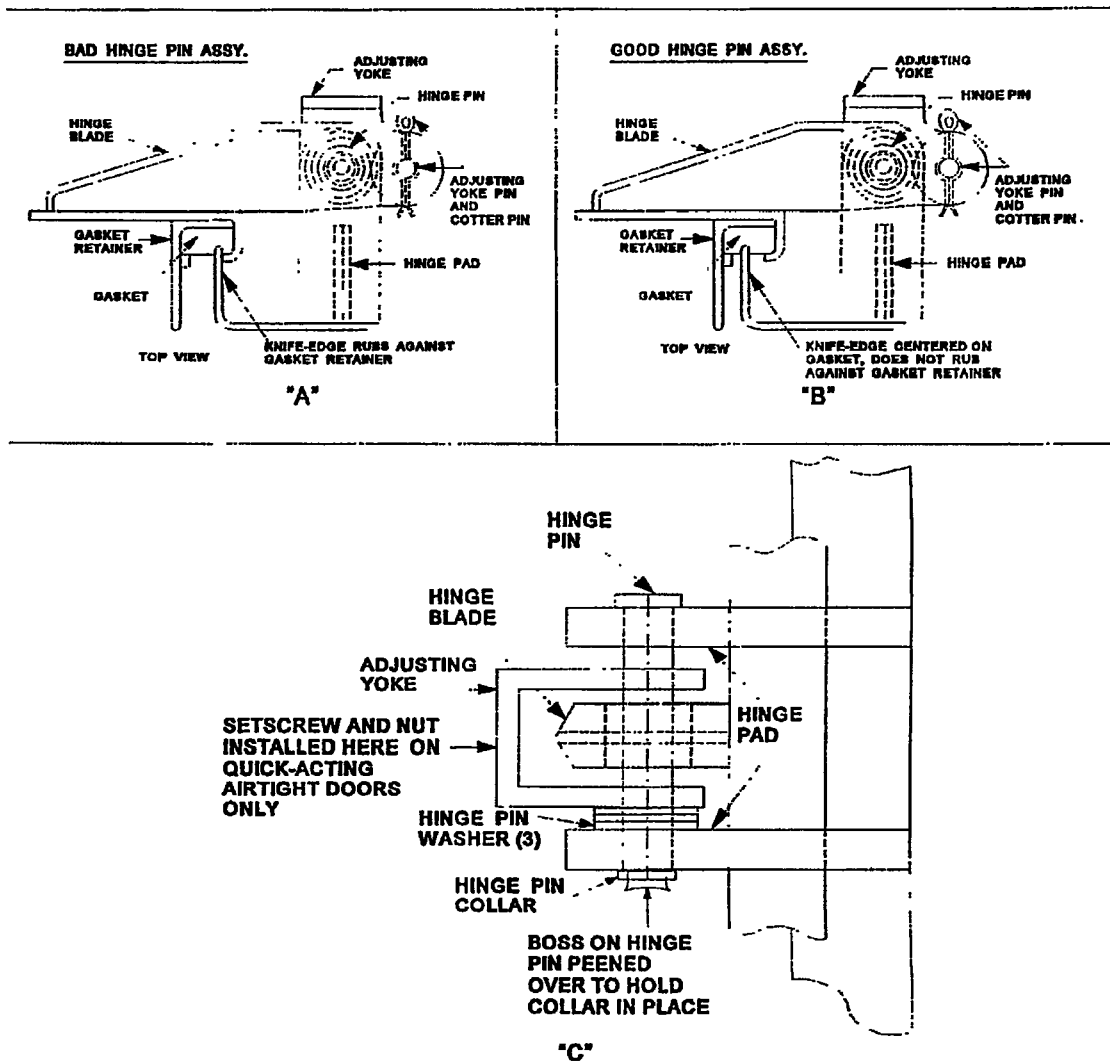


Figure 600-2.9. Hinge Pin Assemblies

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 600-2.9, "C",
  5. The hinge pin is bent or damaged. Refer to paragraph 600-2.4.2.8 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.

#### NOTE

Aluminum door dog bushings provided by Galaxy are colored Army green due to an anodized finish. This anodized finish is not to be mistaken for paint and is to be left as is – **do not remove the anodized finish from either the straight or flanged bushing.**

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 600-2.10. 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 600-2.11.

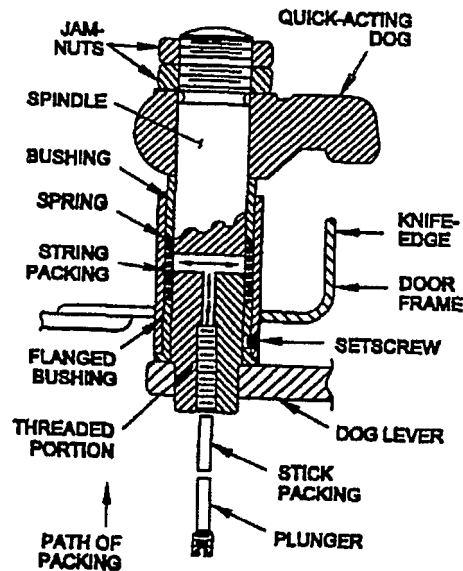


Figure 600-2.10. Quick-Acting Door Dog Assembly (Cross Sectional View)

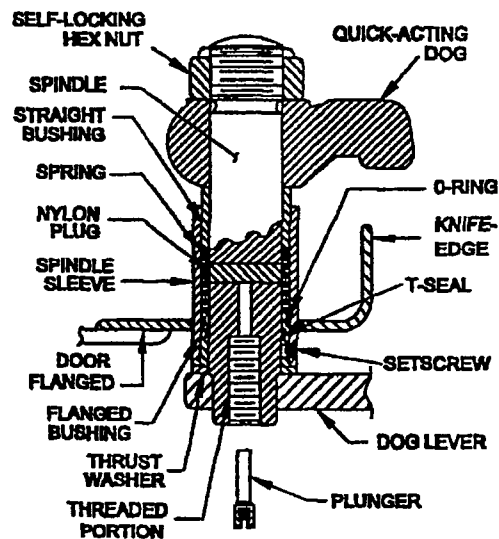


Figure 600-2.11. Quick-Acting Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004 (ECP-444)

- 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.

#### 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 600-2.11.
- 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. 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.
- t. Verify there are no missing, loose, or worn dog wedges. Mechanically fastened wedges should be tight with no movement allowed. A wedge is worn out when it has worn to less than half its original thickness of 5/16" on the flat portion of the wedge or if the leading edge of the taper is 1/16" or less.

#### 600-2.3.2.3 Knife-Edge and Door Frame Inspection.

##### 600-2.3.2.3.1 Aluminum Watertight Doors.

- a. Open the fitting. Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. See figure 600-2.12, figure 600-2.13, and figure 600-2.14. 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.

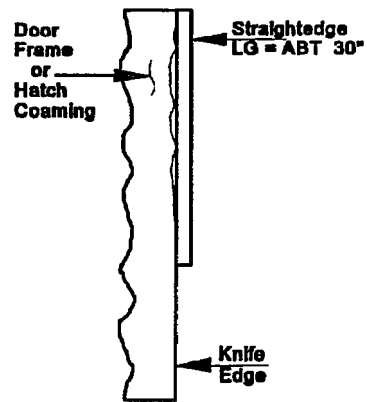


Figure 600-2.12. Knife-Edge Inspection Using Straightedge Method

### 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.

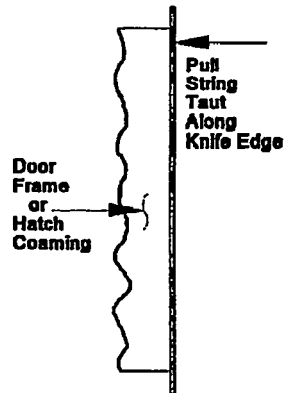


Figure 600-2.13. Knife-Edge Inspection Using String Method

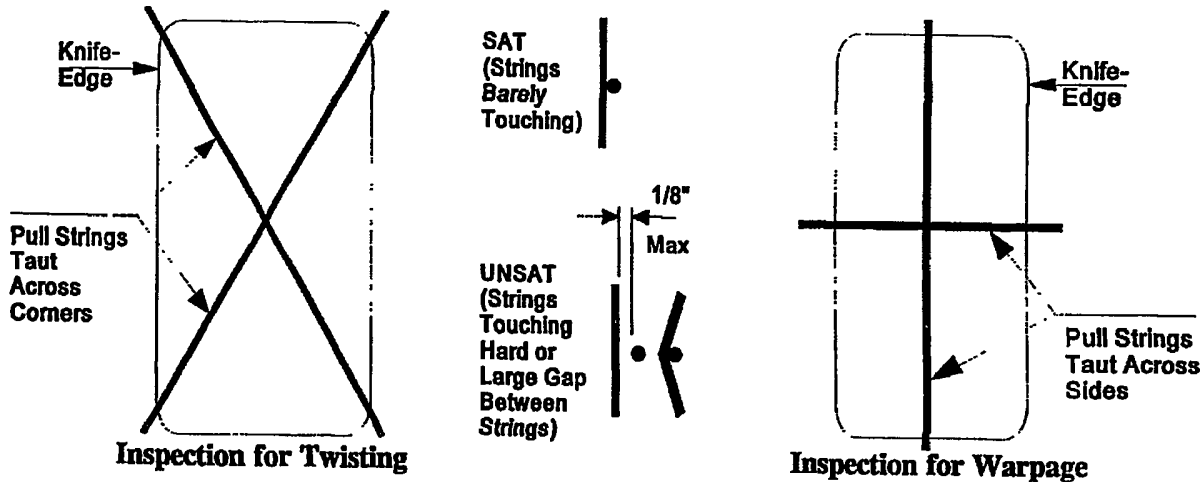


Figure 600-2.14. Knife-Edge Inspection for Warpage

- c. Inspect the entire knife-edge for proper height. A block of aluminum cut to the specifications shown in figure 600-2.15 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.

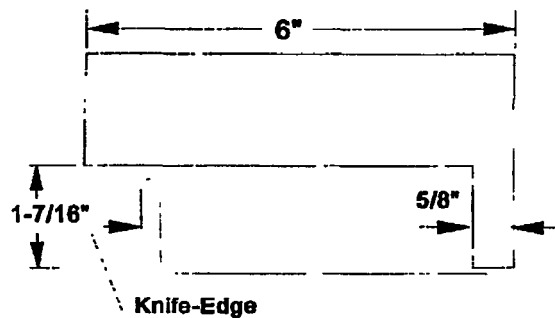


Figure 600-2.15. Gauge for Measuring

#### 600-2.3.2.3.2 Steel Watertight Doors.

- a. Open the fitting. Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. See figure 600-2.16, figure 600-2.17, and figure 600-2.18. 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.

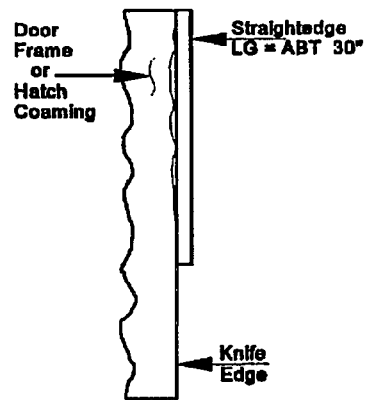


Figure 600-2.16. Knife-Edge Inspection Using Straightedge Method

- 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.**

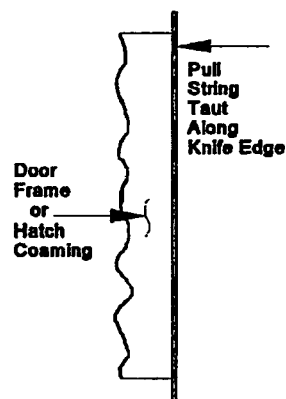


Figure 600-2.17. Knife-Edge Inspection Using String Method

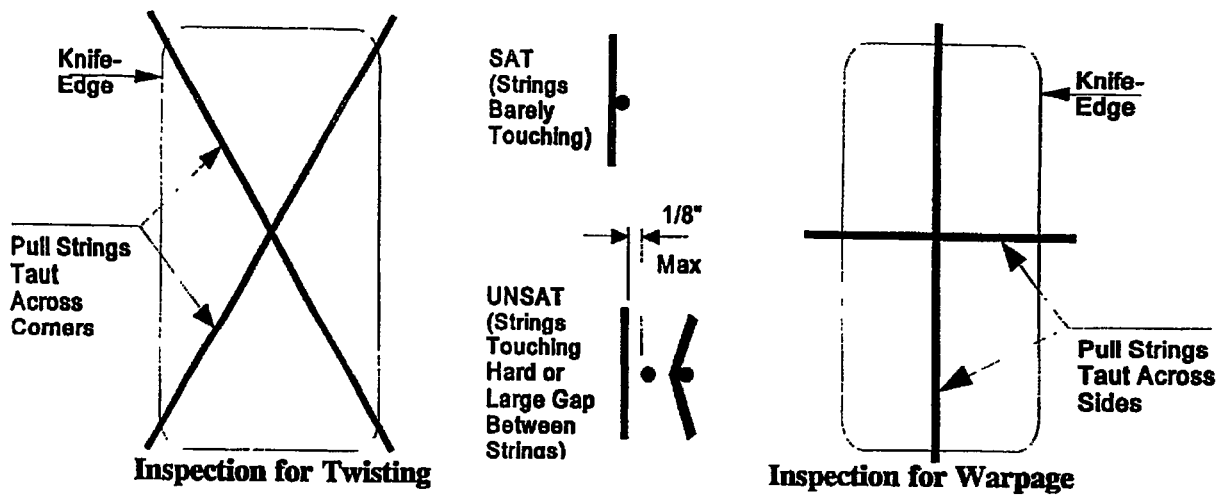


Figure 600-2.18. Knife-Edge Inspection for Warpage

- c. Inspect the entire knife-edge for proper height. A block of aluminum cut to the specifications shown in figure 600-2.19 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.

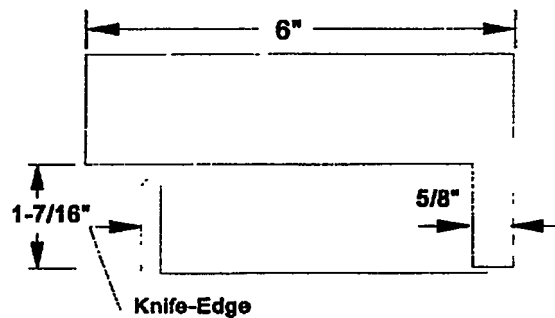


Figure 600-2.19. Gauge for Measuring Knife-edge Height

- 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.

600-2.3.2.4 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 600-2.20.

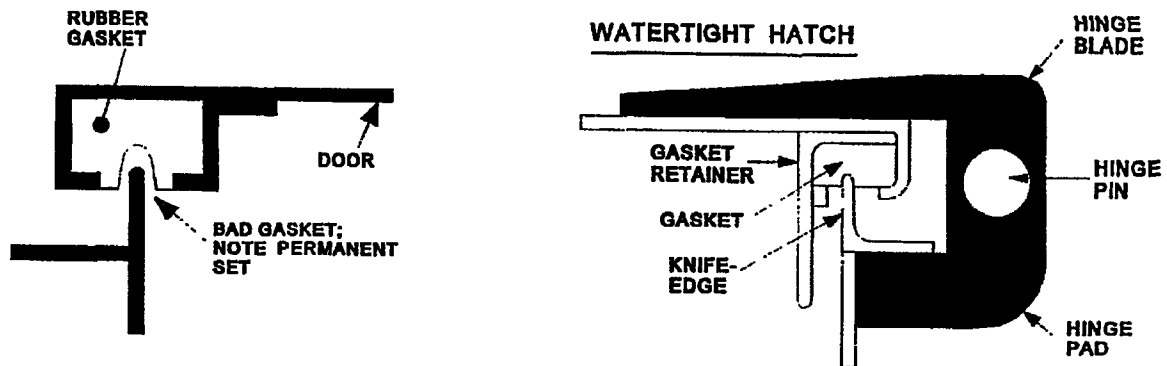


Figure 600-2.20. Gasket Inspection

600-2.3.2.5 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 600-2.3.2.5.1. To chalk test navy standard raised watertight hatches equipped with "drop bolt" type dogs, accomplish paragraph 600-2.3.2.5.2.

600-2.3.2.5.1 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 600-2.4.2.1 for adjusting the dogs to get a consistent seal around the closure.

600-2.3.2.5.2 Chalk Test for Navy Standard Raised Watertight Hatches With Bolt Drop 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 provide 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. Hand tighten each dog lug. After all dog nuts have been hand tightened, tighten each dog nut one full turn with the dog wrench to compress the gasket 1/8" (the drop bolt threads are 3/4-8 acme).
- e. Open the hatch and observe the imprint of the chalk on the gasket. If the chalk line is not continuous the hatch is not watertight and requires further adjustment or repair.

600-2.3.2.6 Hinge Inspection. 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 600-2.21, "A".) A good hinge and alignment are illustrated in figure 600-2.21, "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:

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 600-2.21, "C". The thrust washers or the flange on the hinge pad bushings (on doors without figure 600-2.21. Hinge Pin Assemblies 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 600-2.21, "D".
5. The hinge pin is bent or damaged. Refer to paragraph 600-2.4.2.8 for procedures to repair hinge pin assemblies.

600-2.3.2.7 Dog Inspection.

- a. 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 600-2.22. 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 600-2.23.

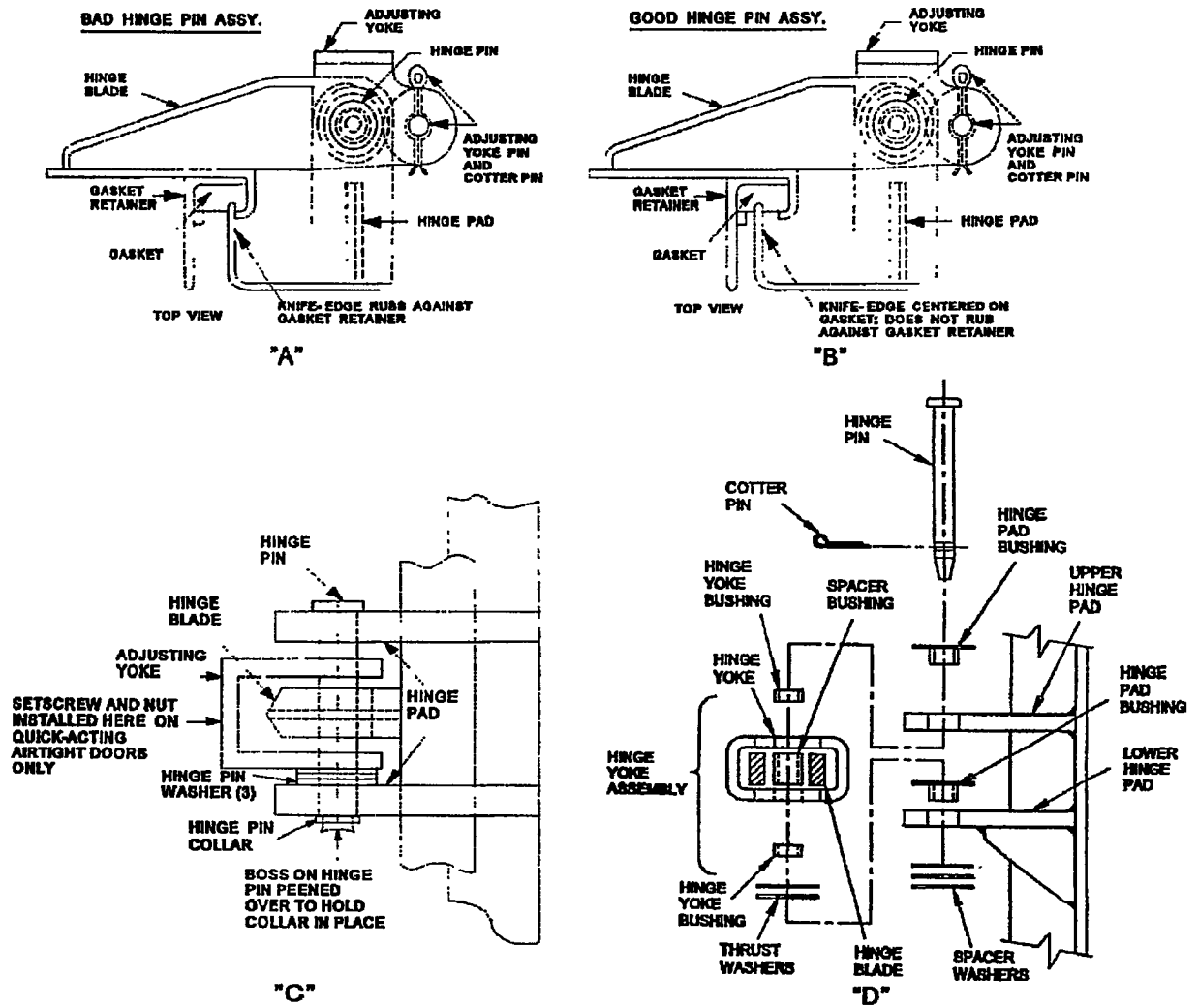


Figure 600-2.21. Hinge Pin Assemblies

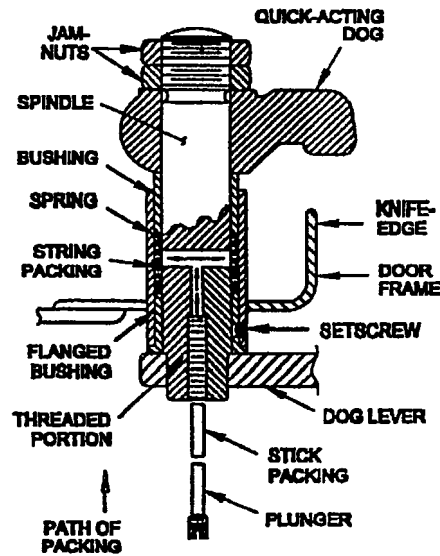


Figure 600-2.22. Quick-Acting Door Dog Assembly (Cross Sectional View)

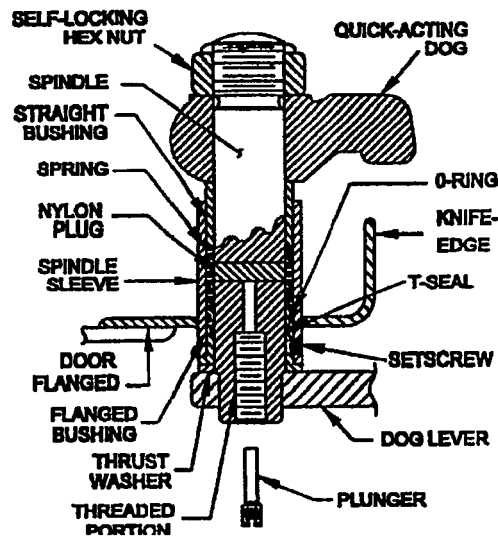


Figure 600-2.23. Quick-Acting Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004(ECP-444)

- b. 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.

- c. 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 600-2.22, figure 600-2.23, and figure 600-2.24.

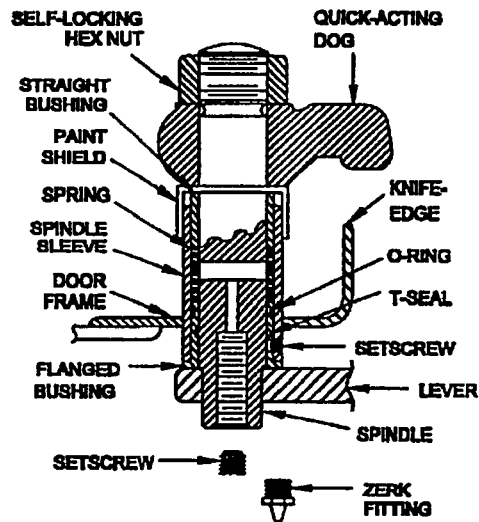


Figure 600-2.24. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- d. Ensure there are no missing, broken, or worn spring clips for operating handle. Spring clip shall positively engage operating handle in the undogged position.
- e. Ensure there is no cracked glass in fixed light.
- f. Ensure proper operation of deadlight cover over fixed light.
- g. Ensure proper operation and condition of door hook and bumper assembly. Verify there are no parts missing and no structural damage.
- h. Ensure proper material for proper hardware on weather deck doors. Dogs, dog spindle nuts, and operating handles should be CRES (nonmagnetic). Verify with magnet.
- i. 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.
- j. 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.
- k. 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 hexnut, 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.
- l. 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.**
- m. 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.

600-2.3.2.8 Inspection of Dog Wedges. Inspect each dog wedge for wear. If a wedge is worn more than half-way 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 backup 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 600-2.25.

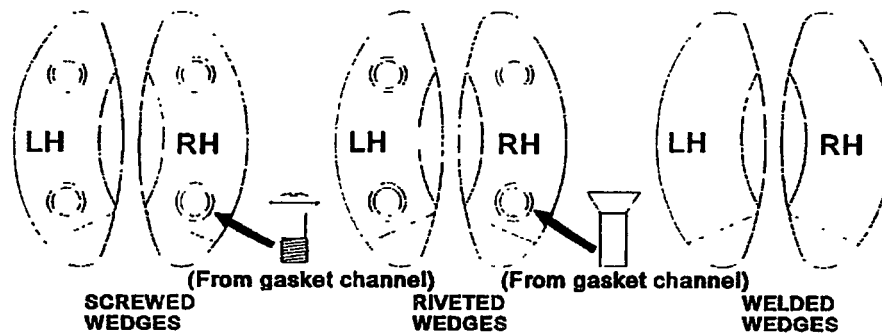


Figure 600-2.25. Watertight Door Wedges

600-2.3.2.9 Inspection of Quick-Acting Door Operating Handle. 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.

600-2.3.2.10 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.

600-2.3.2.11 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 paragraph 600-2.4.2.7.3 for procedures on repairing studs. Failure of even one stud will cause complete failure of the entire door linkage. See figure 600-2.26.

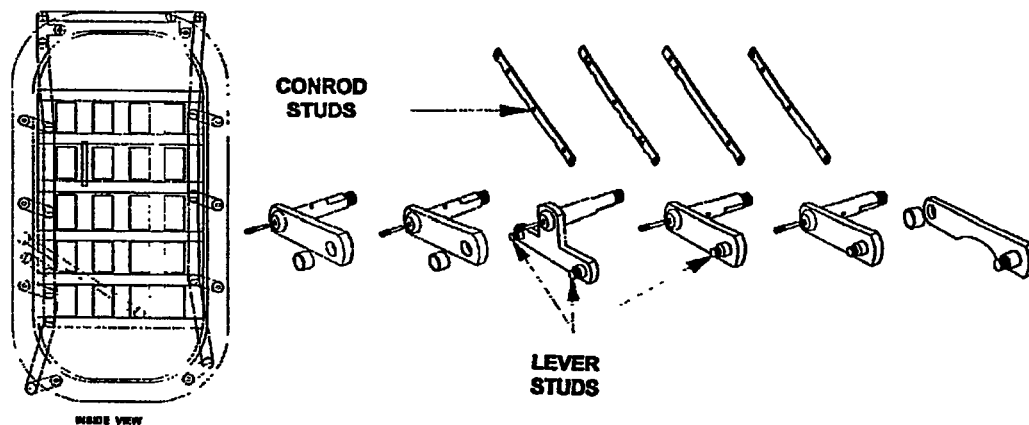


Figure 600-2.26. Quick-Acting Watertight Door Lever and Connecting Rod Studs

### 600-2.3.3 Individually Dogged Doors.

600-2.3.3.1 General Inspection Procedures for Steel Watertight Doors. The following inspection procedure applies to steel individually dogged doors.

- a. Examine the knife-edge and gasket as described in paragraph 600-2.3.2.3 and paragraph 600-2.3.2.4.
- b. Accomplish the chalk test as described in paragraph 600-2.3.2.5.
- 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 600-2.27, "A"). A good hinge and alignment are illustrated in figure 600-2.27, "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:
  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 600-2.27, "C". The thrust washers or the flange on the hinge pad bushings (on doors without Figure 600-2.27. Hinge Pin Assemblies 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 600-2.27, "D".
  5. The hinge pin is bent or damaged. Refer to paragraph 600-2.4.2.8 for procedures to repair hinge pin assemblies.
- e. Ensure the device for holding the door open is intact and workable.



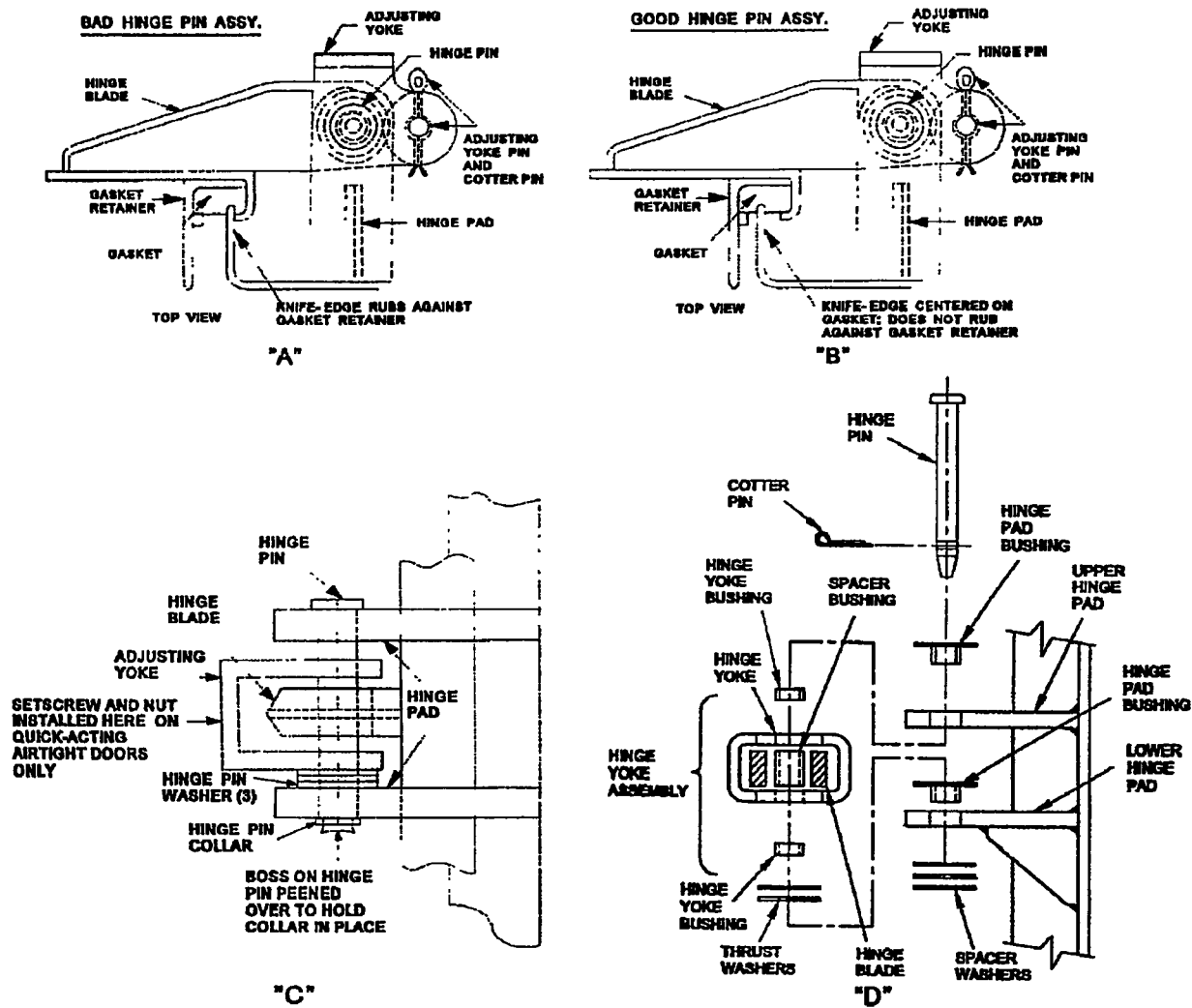


Figure 600-2.27. Hinge Pin Assemblies

- 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 600-2.28. 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 handle and the face of the flanged bushing. See figure 600-2.29.



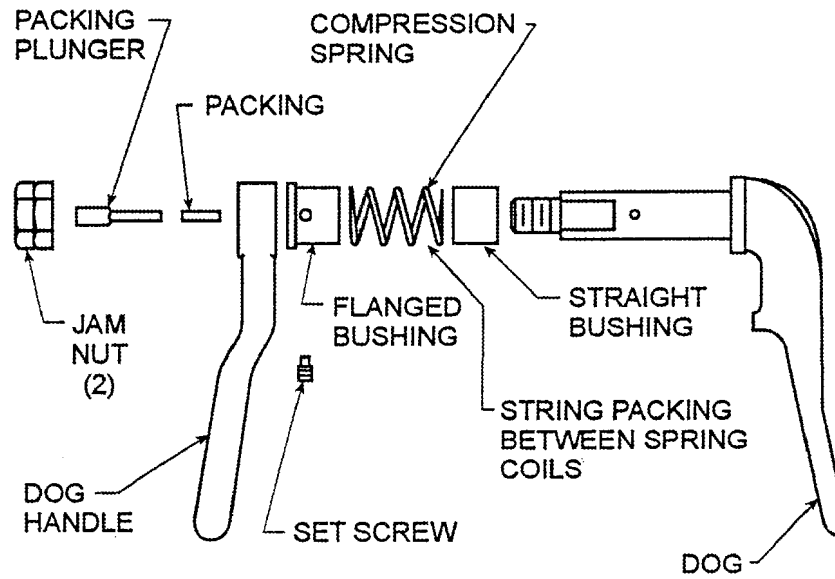


Figure 600-2.28. Individually Dogged Door Dog Assembly (Cross Sectional View)

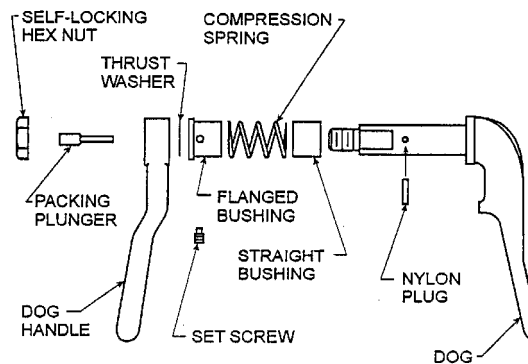


Figure 600-2.29. Individually Dogged Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004(ECP-444)

- 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 600-2.28, figure 600-2.29, and figure 600-2.30.

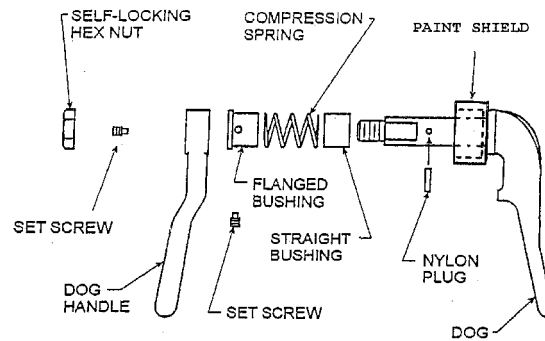


Figure 600-2.30. Individually Dogged Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- 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 hexnut, 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.

600-2.3.3.2 General Inspection Procedures of Aluminum Individually Dogged Watertight Doors. The following inspection steps apply to aluminum individually dogged watertight doors:

- a. Examine the knife-edge and gasket as described in paragraph 600-2.3.2.3 and paragraph 600-2.3.2.4.
- b. Accomplish the chalk test in accordance with paragraph 600-2.3.2.5.
- 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 600-2.31, "A". A good hinge and alignment are illustrated in figure 600-2.31, "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.

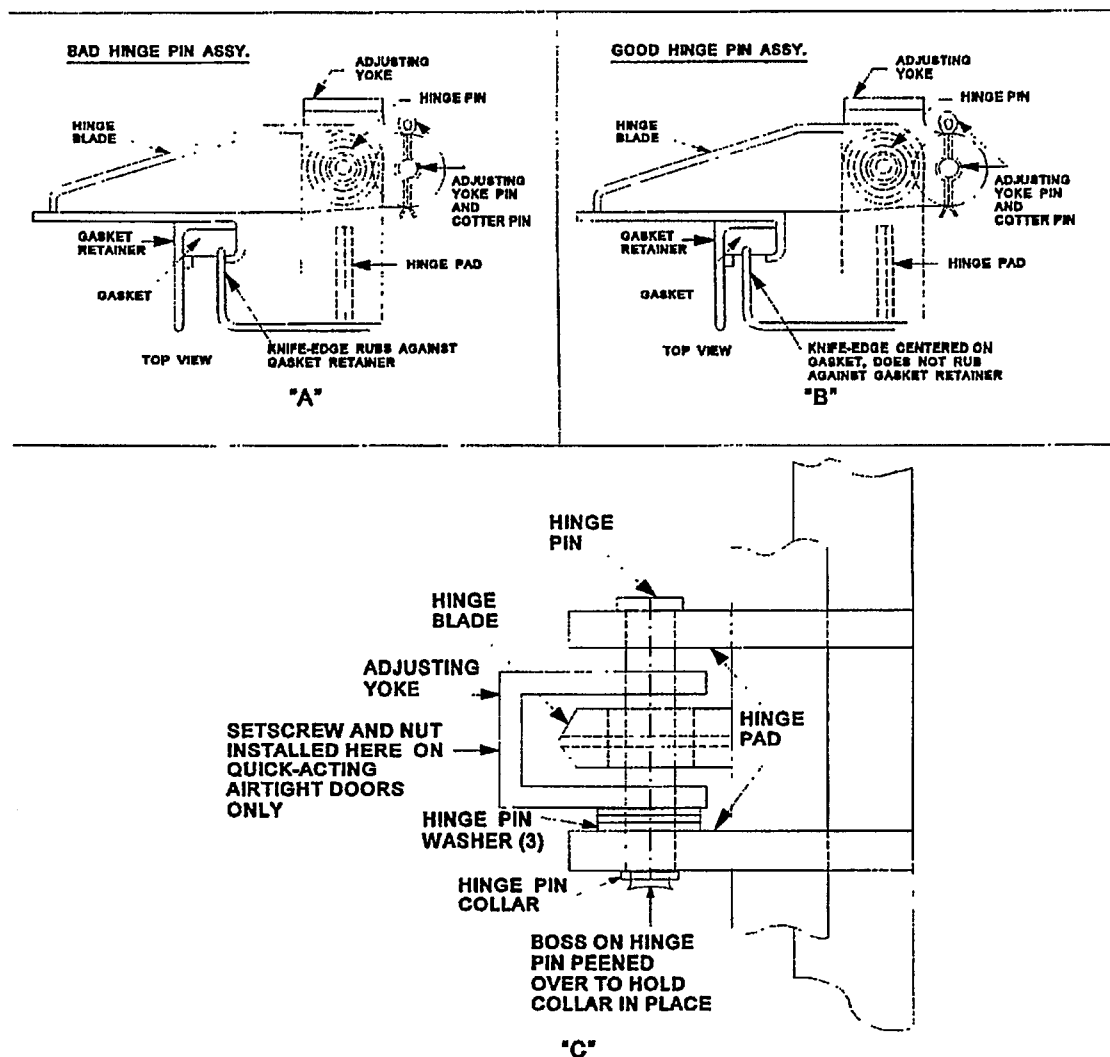


Figure 600-2.31. Hinge Pin Assemblies

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 600-2.3 1, "C",
  5. The hinge pin is bent or damaged. Refer to paragraph 600-2.4.2.8 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.

### NOTE

Aluminum door dog bushings provided by Galaxy are colored Army green due to an anodized finish. This anodized finish is not to be mistaken for paint and is to be left as is – **do not remove the anodized finish from either the straight or flanged bushing.**

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 600-2.32. 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 600-2.33.

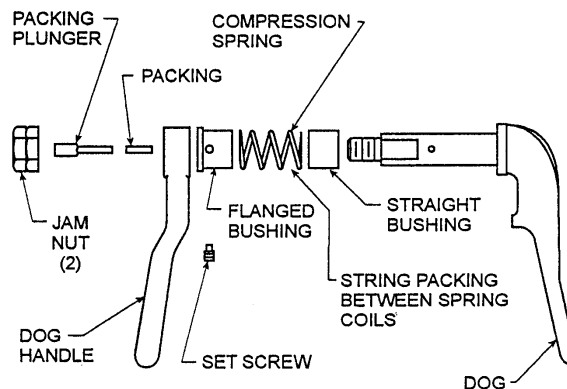


Figure 600-2.32. Individually Dogged Door Dog Assembly (Cross Sectional View)

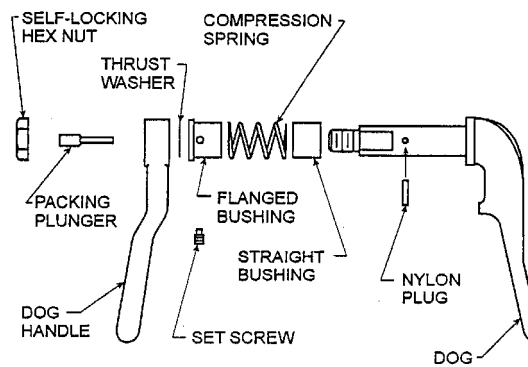


Figure 600-2.33. Individually Dogged Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004 (ECP-444)

- 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.

#### 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 figures 600-2.32 and 600-2.33.
- 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. 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.

600-2.3.3.3 Knife-Edge and Door Frame Inspection.

600-2.3.3.3.1 Aluminum.

- a. Open the fitting. Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. See figure 600-2.34, figure 600-2.35, and figure 600-2.36. 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.

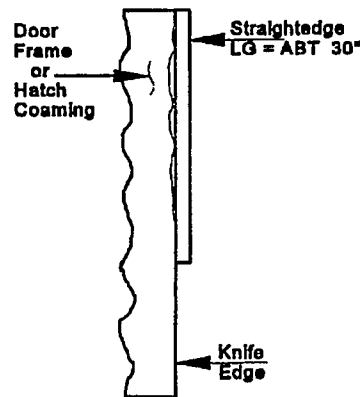


Figure 600-2.34. Knife-Edge Inspection Using Straightedge Method

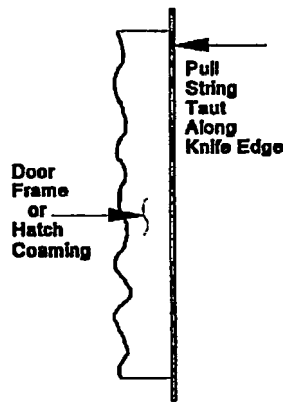


Figure 600-2.35. Knife-Edge Inspection Using String Method

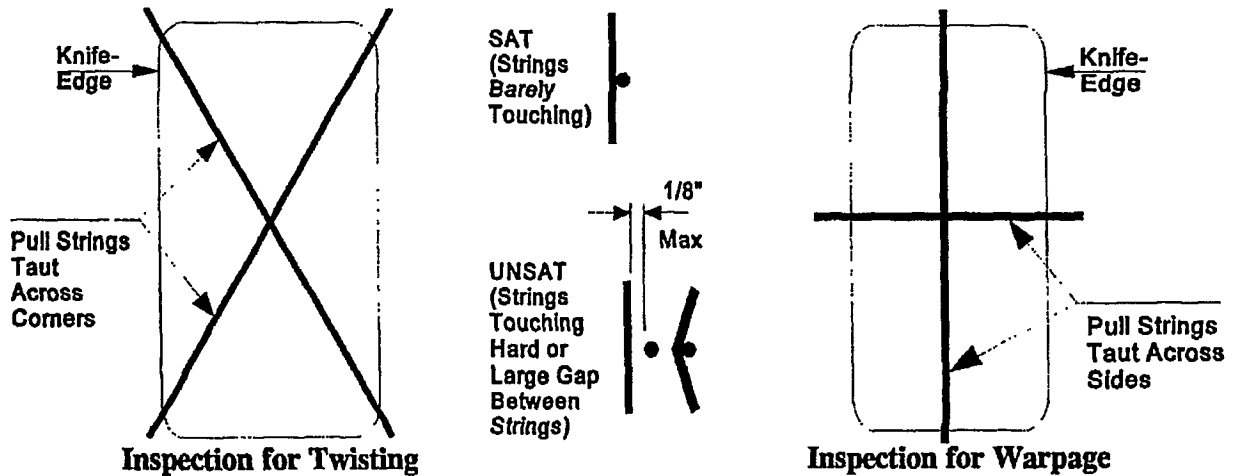


Figure 600-2.36. Knife-Edge Inspection for Warpage

- 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.

### 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 600-2.37 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.

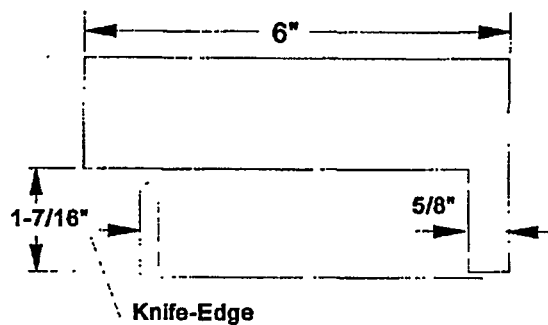


Figure 600-2.37. Gauge for Measuring

- 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.

#### 600-2.3.3.3.2 Steel.

- a. Open the fitting. Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. See figure 600-2.38, figure 600-2.39, and figure 600-2.40. 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.

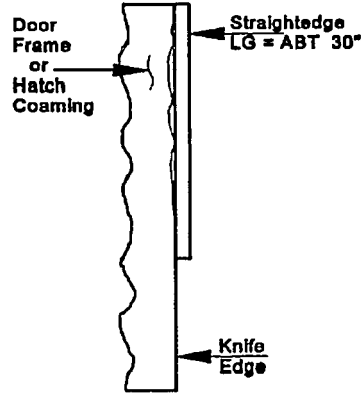


Figure 600-2.38. Knife-Edge Inspection Using Straightedge Method

- 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.

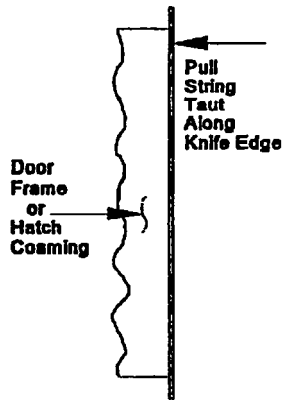


Figure 600-2.39. Knife-Edge Inspection Using String Method



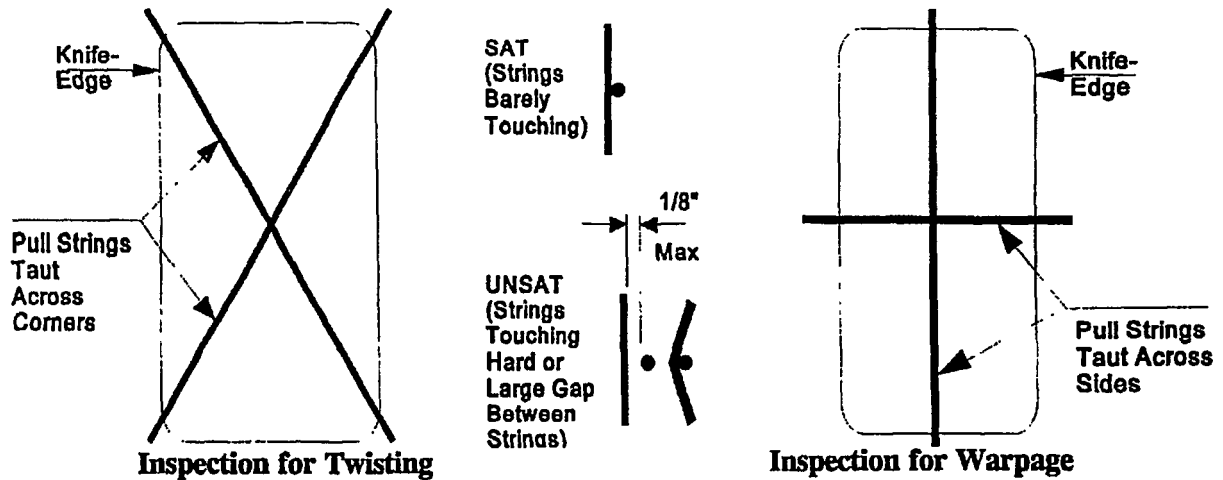


Figure 600-2.40. Knife-Edge Inspection for Warpage

**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 600-2.41 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.

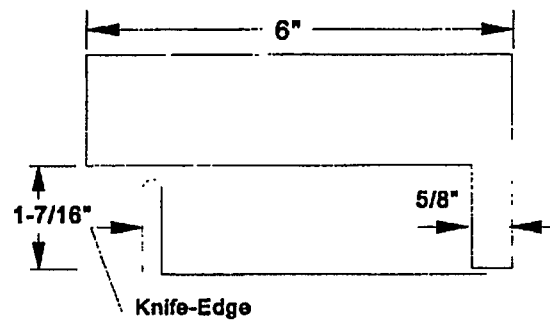


Figure 600-2.41. Gauge for Measuring Knife-edge Height

- 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.

600-2.3.3.4 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:

- a. The rubber must be soft and pliable, and have no cracks.
- b. There should be no paint, rust, or other foreign matter.
- c. The gasket joint should be located at the top of the door.
- d. There must be no gaps in the gasket joint. Replace the gasket if there is separation where the two ends join.

- e. 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 600-2.42.

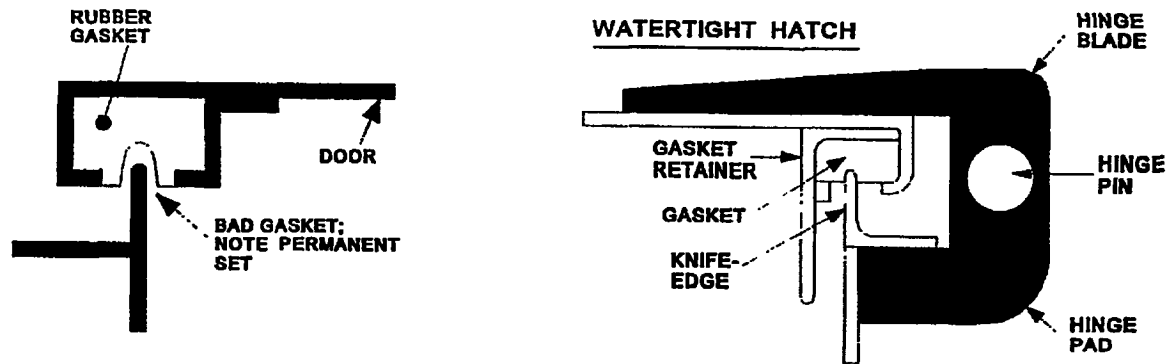


Figure 600-2.42. Gasket Inspection

600-2.3.3.5 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 600-2.3.3.5.1. To chalk test navy standard raised watertight hatches equipped with "drop bolt" type dogs, accomplish paragraph 600-2.3.3.5.2.

600-2.3.3.5.1 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 600-2.4.2.1 for adjusting the dogs to get a consistent seal around the closure.

600-2.3.3.5.2 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. Hand tighten each dog nut until seated firmly against the dog lug. After all dog nuts have been hand tightened, 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.

600-2.3.3.6 Hinge Inspection. Visually inspect the hinge sleeves and hinge pins (on doors without Machinery Alteration (MACHALT) 167-31006 Engineering Change Proposal (ECP) 518 or MACHALT 167-31011 (ECP-538) 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) or MACHALT 167-31011 (ECP-538) 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 600-2.43, "A") A good hinge and alignment are illustrated in figure 600-2.43, "B.". Replace the hinge pin washers and/or pins (on doors without MACHALT 167-3 1006 (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:

- a. The metal surrounding the top and bottom of the door gasket rubs against the knife-edge.
- b. The door panel rubs one or more dogs, particularly at the bottom of the door.
- c. The door chafes the knife-edge when opened and closed.
- d. 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 600-2.43, "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 600-2.43, "D".
- e. The hinge pin is bent or damaged. Refer to paragraph 600-2.4.2.8 for procedures to repair hinge pin assemblies.

600-2.3.3.7 Individual Dog and Handle Assembly Inspection.

- a.

#### NOTE

Aluminum dog door bushings provided by Kamatics and Galaxy are colored Army green due to an anodized finish. This anodized finish is not to be mistaken for paint and is to be left as is – **DO NOT remove the anodized finish.**

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 600-2.44. 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 600-2.45.

- b. 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.

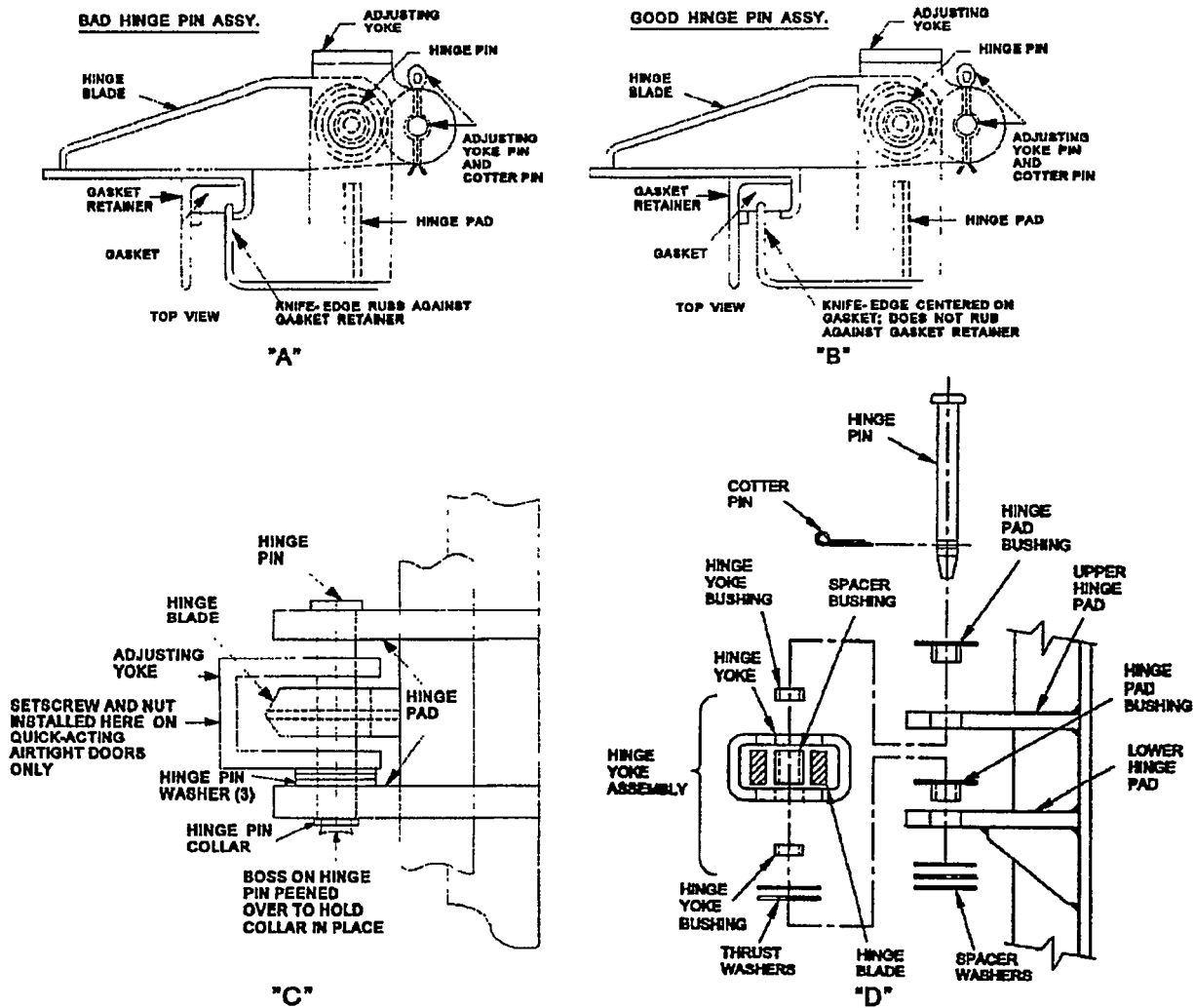


Figure 600-2.43. Hinge Pin Assemblies

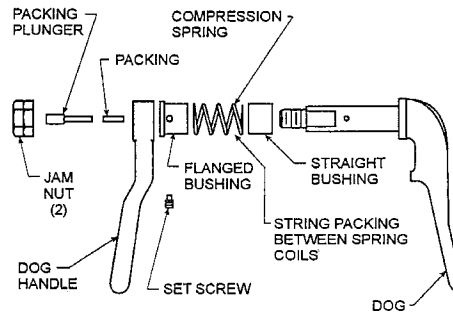


Figure 600-2.44. Individually Dogged Door Dog Assembly (Cross Sectional View)

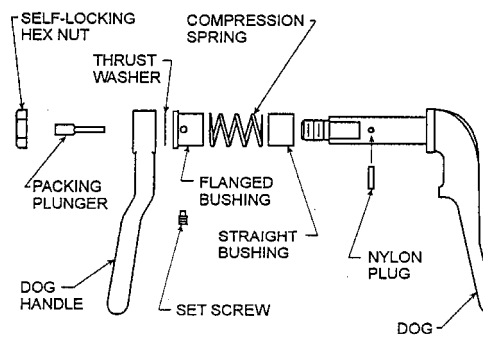


Figure 600-2.45. Individually Dogged Door Dog Lever Assembly (Cross Sectional View) Modified by MACHALT 167-31004(ECP-444)

#### NOTE

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

- c. 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 600-2.44, figure 600-2.45, and figure 600-2.46.

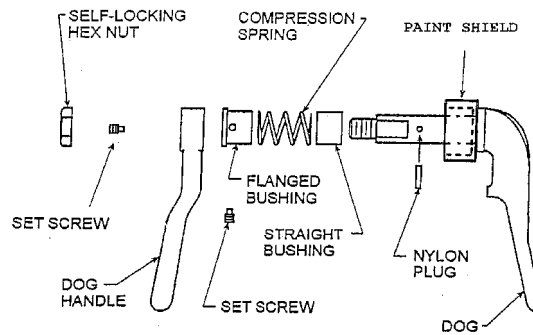


Figure 600-2.46. Steel Doors Only - Individually Dogged Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- d. Ensure there are no missing, broken, or worn spring clips for operating handle. Spring clip shall positively engage operating handle in the undogged position.
- e. Ensure there is no cracked glass in fixed light.
- f. Ensure proper operation of dead light cover over fixed light.
- g. Ensure proper operation and condition of door hook and bumper assembly. Verify there are no parts missing and no structural damage.
- h. Ensure proper material for proper hardware on weather deck doors. Dogs, dog spindle nuts, and operating handles should be CRES (nonmagnetic). Verify with magnet.
- i. 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.
- j. 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.
- k. 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 hexnut, 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.
- l. 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.**
- m. 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.
- n. 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 600-2.4.2.1. String and stick packing are not required for doors with self-lubricated bushings installed. Refer to paragraph 600-2.4.2.6 through paragraph 600-2.4.2.7 for procedures on disassembling and repairing handles.

600-2.3.3.8 Inspection of Dog Wedges. Inspect each dog wedge for wear. If a wedge is worn more than half-way 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 paragraph 600-2.4.2.9 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 backup 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 600-2.47.

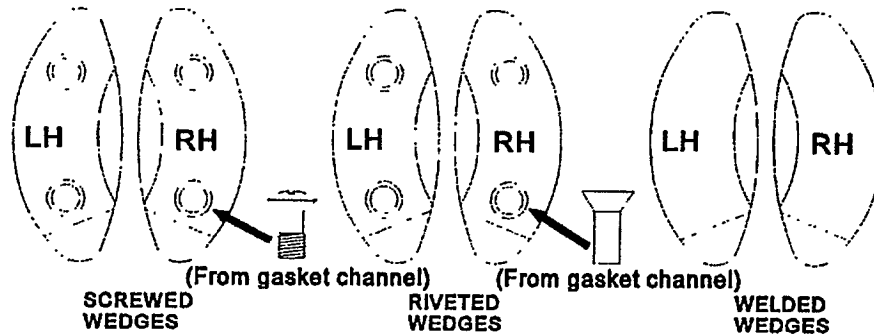


Figure 600-2.47. Watertight Door Wedges

#### 600-2.4 Watertight Door Repair.

600-2.4.1 Door Repair. If routine maintenance is not sufficient to restore a watertight door to watertight or operating condition, defective parts must be repaired or replaced. If the answer to the problem is not covered in chapter 2 or in the appendices, consult the appropriate technical point of contact at Naval Surface Warfare Center, Carderock Division - Ship Systems Engineering Station (NSWCCD-SSES), or a commercial point of contact. When accomplishing maintenance or repairs on a door, avoid the following:

- a. Never bend, twist, or beat the door.
- b. Never use a pneumatic grinder to grind the knife-edge. If the knife-edge requires dressing, use a file to remove the nicks. Never use a Wheeze bar or large crescent wrench to bend or twist the knife-edge.
- c. Never use excess force to close a door.
- d. Never let doors in major egress areas go without repair.
- e. Never paint a gasket, dog, dog wedge, spindle threads, spindle nut, knife-edge, straight bushing, or label plate.
- f. For gasket replacement, never use more than one continuous length of gasket material.
- g. Use only a blunt instrument to install gaskets. Never use a screwdriver, scraper, or knife.
- h. Never apply paint to moving components on the hinge assembly, as components must remain free to move.

## 600-2.4.2 Quick-Acting Watertight/Airtight Doors.

600-2.4.2.1 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.**

### **NOTE**

If replacing gasket, accomplish dog adjustment procedures before installing new gasket.

Inspection procedures for watertight closure gaskets are provided in paragraph [600-2.3.2.4](#). If a gasket fails the inspection, accomplish the procedures in paragraph [600-2.4.2.1.1](#) through paragraph [600-2.4.2.1.2](#).

#### 600-2.4.2.1.1 Gasket 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 [600-2.47A](#)



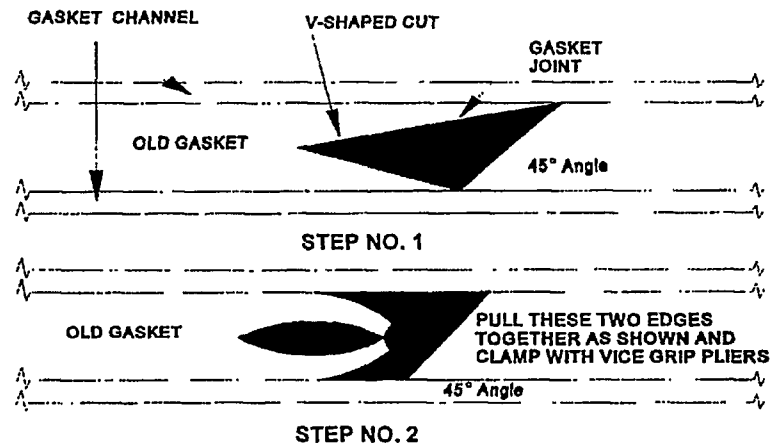


Figure 600-2.47A Gasket Removal

**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.

600-2.4.2.1.2 Installation of ZZ-R-765 (CID-A-59588) Silicone Gasket. The ZZ-R-765 Silicone, Class 3B, 30 Durometer, is authorized for all watertight closures except ballistic closures.

**NOTE**

Accomplish dog adjustment procedures, para. 600-2.4.2.2.1, **before** installing new gasket. (Adjusting the dogs without the gasket installed is more accurate than adjusting the dogs with the gasket installed.)

**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.

600-2.4.2.2 Quick-Acting 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 600-2.4.2.2.1) has proven to be the most accurate. However, this procedure must be accomplished with the gasket removed. Method 2 (refer to paragraph 600-2.4.2.2.2) 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.

600-2.4.2.2.1 Quick-Acting Watertight/Airtight Door Dog 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.

- Loosen all jamnuts or self-locking nuts and hinge adjusting screws (airtight doors only).
- Remove the existing gasket. If in satisfactory condition, save gasket for reinstallation.
- 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.
- Close the door and dog door down.
- 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 600-2.48.

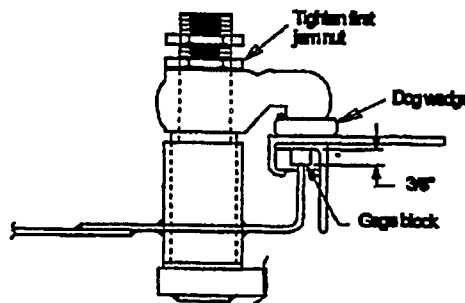


Figure 600-2.48. Dog Adjustment without Gasket Installed

- Where jamnuts are used, tighten the second jamnut securely against the first jamnut.
- Repeat step b through step f for each dog.
- Reinstall gasket.

600-2.4.2.2.2 Quick-Acting Watertight Door (with gasket installed) Dog Adjustment Method 2. This procedure, when followed, will ensure proper adjustment of the dogs and hinges on a quick acting watertight door to provide the required 1/8" gasket compression when in the fully dogged position.

#### NOTE

For safety purposes, secure the area on both sides of the door, or post a second person on the opposite side of the door to prevent personnel from passing through the access while performing this adjustment procedure. Read all steps in this procedure before beginning! Prior to performing any adjustment, ensure all

hinge components are properly installed, free of wear, hinge yokes move freely, and there is no metal to metal contact between the knife-edge and gasket channel (see figure 600-2.48A) when the door is in the dogged position. If metal-to-metal contact is present, the quantity of hinge washers may need to be adjusted. If metal-to-metal contact cannot be corrected by adjusting the quantity of hinge washers, initiate action to repair (i.e. remove & relocate hinge pads) or replace door.

Tools and material required:

Wrench, adjustable, 14”

Wrench, engineers, open end, 1-5/16”

Chalk

Rags

Paper, strip 3” x 11”

Marker, felt tip

Cloth, abrasive, 320 grit

600-2.4.2.2.2.1 Adjustment Procedure

- a. Close and fully dog the door.
- b. Loosen all self-locking dog spindle nuts (see figure 600-2.48A) or jam nuts (see figure 600-2.48B) until all dogs and wedges are clearly separated.
- c. Un-dog and open the door.
- d. Using a rag, clean the knife-edge and gasket. If paint is present on knife-edge, remove using 320 grit abrasive cloth. Apply chalk to the gasket contact surface of the knife-edge.
- e. Close the door lightly but do not dog. Push firmly from the outside of the door at the center of the door panel to obtain a chalk imprint on the gasket.
- f. Open the door and examine the gasket to determine where the chalk transferred from the knife-edge to the gasket. Gasket areas without chalk indicate the knife-edge and gasket did not make contact when the door was closed.

**NOTE**

If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area where the chalk is not visible on the gasket. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again.

- g. To aid in the dog adjustment sequence, mark with chalk on the outside of the door panel, the dog wedges in the areas where the gasket contacted the knife-edge. These are the areas where dog adjustment shall be accomplished first.

**NOTE**

A continuous transfer of chalk indicates the door panel and frame are very straight, and dog adjustment may begin. An imprint of less than 50% indicates the panel or frame is warped and action should be initiated to replace the closure.

**NOTE**

Perform steps (h) through (l) beginning with the dogs closest to areas where gasket made contact with the knife-edge and end with dogs where the gasket did not contact the knife-edge.

**NOTE**

**DO NOT LEAN AGAINST THE PANEL DURING THE ADJUSTMENT PROCEDURE.**

- h. Insert a strip of paper between the gasket and knife-edge in the immediate area of the dog. Close and dog the door. (See figure [600-2.48C](#))
- i. Tighten the self-locking dog spindle nut (or first jam nut) until the paper cannot be pulled out. If the paper is held tightly when the door is first dogged, tighten the dog spindle nut until the dog just makes contact with the wedge
- j. Un-dog and open the door. Repeat steps (h) and (i) until all dogs are completed.
- k. Establish a reference point by using a felt tip marker to place a match-mark on the self-locking nuts or jam nuts and spindles. Using the mark as a point of reference, tighten all self-locking dog spindle nuts (or bottom jam nuts) an additional 1+1/8 turns to achieve 1/8 inch of continuous gasket compression. If dogs are outfitted with jam nuts, tighten each of the second jam nuts against the first by using an adjustable wrench while firmly holding the first jam nut in position with an engineers wrench.
- l. After all adjustments are completed, un-dog and open the door. Using a rag, remove all chalk from the gasket, and perform a final chalk test. Apply chalk to the gasket contact surface of the knife-edge. Close and dog the door. Open the door and observe the chalk imprint of the knife-edge on the gasket. The chalk line should be continuous all around the entire gasket. If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again. If the chalk line on the gasket is still not continuous, back off the self-locking nut or jam nuts in the areas where the chalk imprint is missing, and repeat steps g. through j. as required for those dogs located in the area of non-contact.
- m. Repeat step (l) until a successful chalk test is achieved.
- n. Upon completion, remove chalk from knife-edge and gasket.

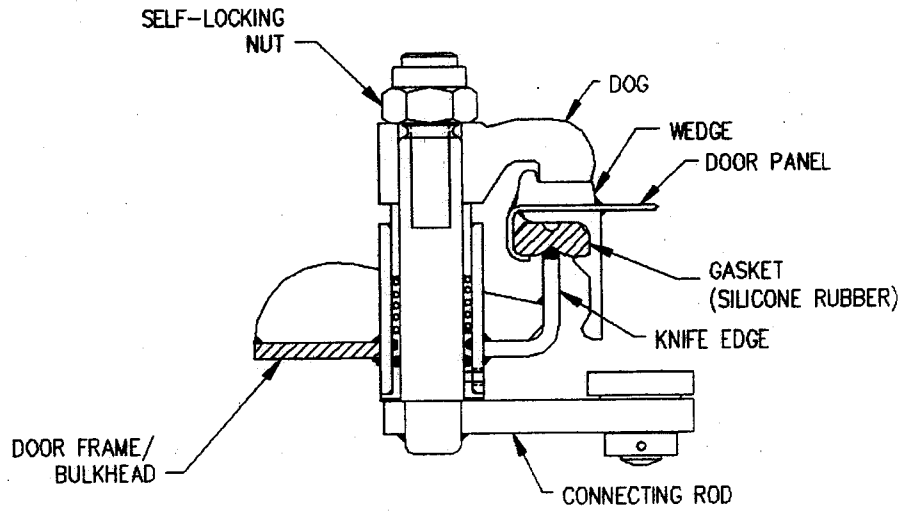


Figure 600-2.48.A. Dog With Self-locking Nut

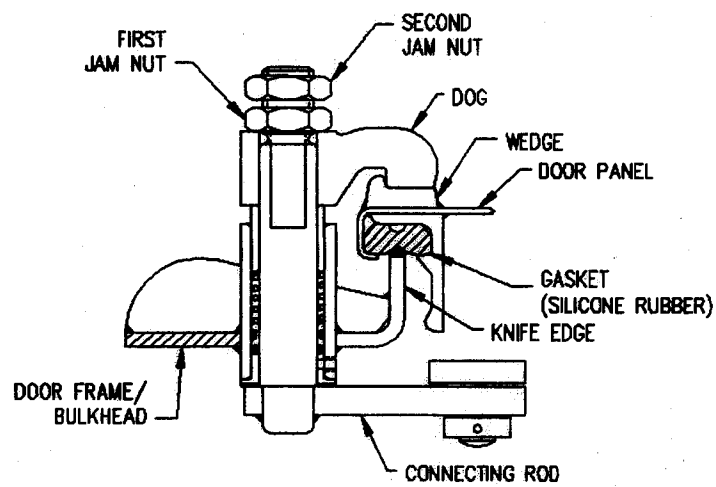


Figure 600-2.48.B Dog With Jam Nuts

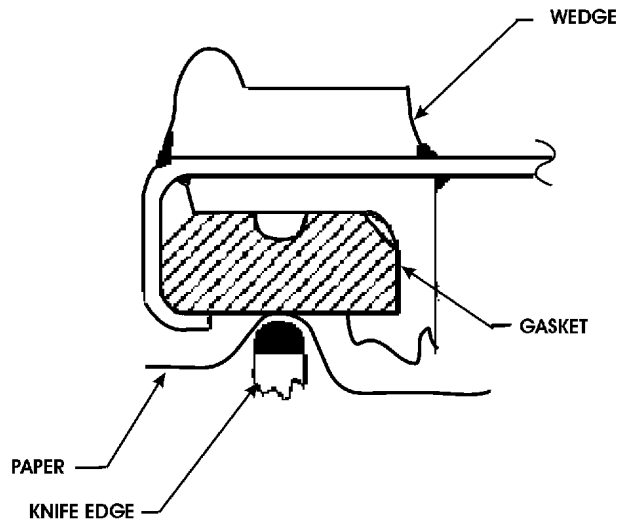


Figure 600-2.48.C Paper Inserted

#### 600-2.4.2.2.3 Quick-Acting Airtight Door Dog and Hinge Adjustment.

600-2.4.2.2.3.1 Adjustment Method 1 (Gasket Removed). 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.

600-2.4.2.2.3.2 Quick Acting Airtight Door, Bound-Hinge, 3-Dog, (with gasket installed) Dog Adjustment, Method 2 This procedure, when followed, will ensure proper adjustment of the dogs and hinges on a quick acting airtight door to provide the required 1/8" gasket compression when in the fully dogged position.

#### NOTE

For safety purposes, secure the area on both sides of the door, or post a second person on the opposite side of the door to prevent personnel from passing through the access while performing this adjustment procedure. Read all steps in this procedure before beginning! Prior to performing any adjustment, ensure all bound hinge components are properly installed, free of wear, hinge yokes move freely, and there is no metal to metal contact between the knife-edge and gasket channel (see figure 600-2.48D) when the door is in the dogged position. If metal-to-metal contact is present, the quantity of hinge washers may need to be adjusted. If metal-to-metal contact cannot be corrected by adjusting the quantity of hinge washers, initiate action to repair (i.e. remove & relocate hinge pads) or replace door.

Tools and material required:

Wrench, adjustable, 14"

Wrench, engineers, open end, 1-5/16"

Wrench, Allen, 1/4" hex

Chalk

Rags

Paper, strip 3" x 11"

Marker, felt tip

Cloth, abrasive, 320 grit

#### 600-2.4.2.2.3.2.1 Adjustment Procedure

- a. Close and fully dog the door.
- b. Loosen all 3 self-locking dog spindle nuts (see figure 600-2.48D) or jam nuts (see figure 600-2.48E) until all dogs and wedges are clearly separated.
- c. Loosen the 3 hinge adjusting screw lock nuts and adjusting screws until they are clearly separated and not applying any closing force to the hinges (see figure 600-2.48F).
- d. Un-dog and open the door.
- e. Using a rag, clean the knife-edge and gasket. If paint is present on knife-edge, remove using 320 grit abrasive cloth. Apply chalk to the gasket contact surface of the knife-edge.
- f. Close the door lightly but do not dog. Push firmly against the outside of the door panel at the center to obtain a chalk imprint on the gasket.
- g. Open the door and examine the gasket to determine where the chalk transferred from the knife-edge to the gasket. Gasket areas without chalk indicate the knife-edge and gasket did not make contact when the door was closed.

#### NOTE

The chalk line should be continuous all around the entire gasket. If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again.

- h. To aid in the hinge and dog adjustment sequence, mark with chalk on the outside of the door panel, the dog wedges and/or hinges in the areas where the gasket contacted the knife-edge. These are the areas where dog/hinge adjustment shall be accomplished first.

#### NOTE

A continuous transfer of chalk indicates the door panel and frame are very straight, and dog adjustment may begin. An imprint of less than 50% indicates the panel or frame is warped and action should be initiated to replace the closure.

#### NOTE

Perform steps (i) through (j) on the hinge side of door, beginning with hinges identified in step (h) closest to areas where gasket made contact with the knife-edge and finish with hinges that gasket did not contact the knife-edge.

**NOTE**

**DO NOT LEAN AGAINST THE PANEL DURING THE ADJUSTMENT PROCEDURE**

- i. Insert a strip of paper between the gasket and knife-edge in the immediate area of the hinge. Close and dog the door. (See figure 600-2.48G)
- j. Tighten the hinge-adjusting screw until the paper cannot be pulled out. If the paper is held tightly when the door is first dogged, tighten the hinge screw until it just contacts the hinge blade. Ensure the lock nut is backed off sufficiently to allow free rotation of the adjusting screw.
- k. Un-dog and open the door, and repeat step (i) and (j) at the next marked hinge, identified in step (h), until all hinge-adjusting screws are completed. If there are no more marked hinges, adjust the remaining hinges. **DO NOT TIGHTEN LOCKNUT AT THIS TIME!**

**NOTE**

Perform steps (m) through (q) on the dog side of the door, beginning with the dogs identified in step (h) that are closest to areas where gasket made contact with the knife-edge and finish with dogs where the gasket did not contact the knife-edge.

**NOTE**

**DO NOT LEAN AGAINST THE PANEL DURING THE ADJUSTMENT PROCEDURE**

- l. Insert a strip of paper between the gasket and knife-edge in the immediate area of the dog. Close and dog the door (see figure 600-2.48G).
- m. Tighten the self-locking dog spindle nut (or first jam nut) until the paper cannot be pulled out. If the paper is held tightly when the door is first dogged, tighten the dog spindle nut until the dog just makes contact with the wedge.
- n. Un-dog, open the door, and repeat steps (l) and (m) until all dogs are completed.
- o. With the door closed and dogged, accomplish steps (p) through (t).
- p. For the hinge adjusting screws, establish a reference point by using a felt tip marker to place a match-mark on the yoke and adjusting screw threads. Using the match-mark as a point of reference, tighten all hinge-adjusting screws an additional 1+5/8 turns to achieve 1/8 inch of continuous gasket compression. Tighten the jam nuts to lock the hinge adjusting screws in place while holding the hinge adjusting screw firmly in position with an Allen wrench.
- q. For the dogs, establish a reference point by using a felt tip marker to place a match-mark on the self-locking nuts or jamb nuts and spindles. Using the mark as a point of reference, tighten all self-locking dog spindle nuts (or bottom jam nuts) an additional 1+1/8 turns to achieve 1/8 inch of continuous gasket compression. If dogs are outfitted with jam nuts, tighten each of the second jam nuts against the first by using an adjustable wrench while firmly holding the first jam nut in position with an engineers wrench.
- r. After all adjustments are completed, un-dog and open the door. Using a rag, remove all chalk from the gasket, and perform a final chalk test. Apply chalk to the gasket contact surface of the knife-edge. Close and dog the door. Open the door and observe the chalk imprint of the knife-edge on the gasket. The chalk line should be continuous all around the entire gasket. If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply



chalk, dog and un-dog the door again. If the chalk line on the gasket is still not continuous, back off the hinge adjusting screws and/or self-locking nut/ jam nuts in the areas where the chalk imprint is missing, and repeat adjustment steps (l) through (k) as required for those dogs/hinges located in the area of non-contact.

- s. Repeat step (q) until a successful chalk test is achieved.
- t. Upon completion, remove chalk from knife-edge and gasket.

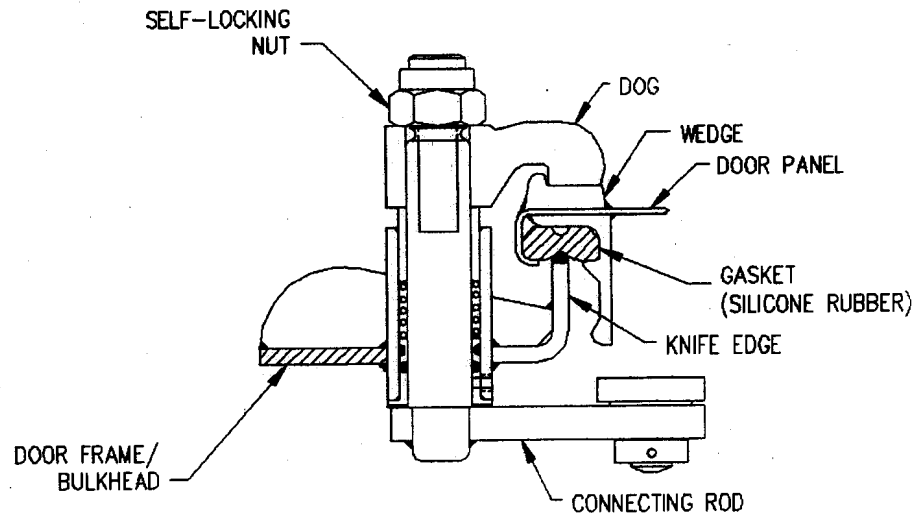


Figure 600-2.48.D Dog With Self-locking Nut

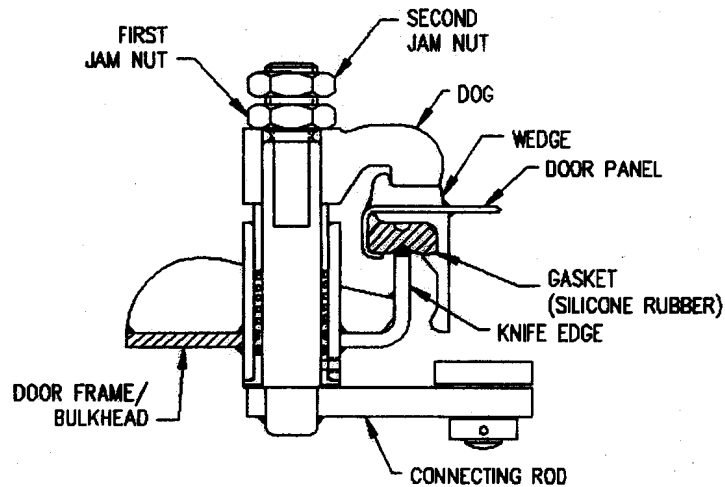


Figure 600-2.48.E Dog With Jam Nuts

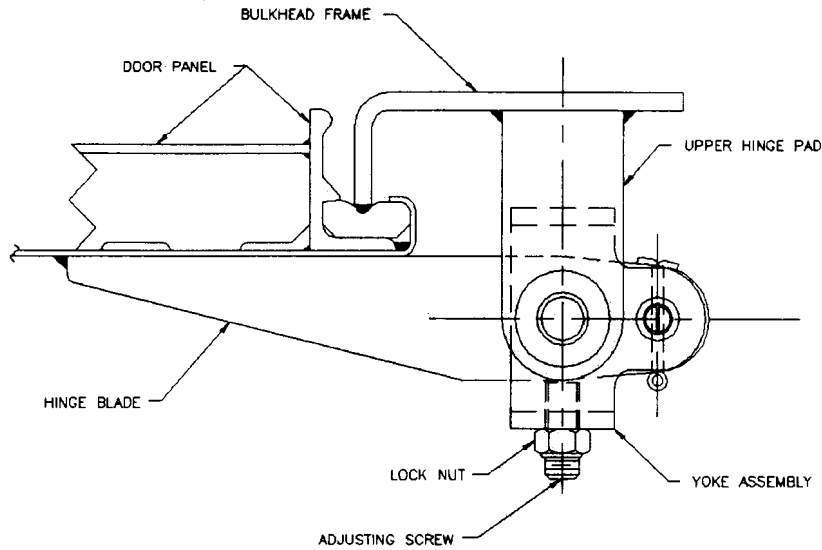


Figure 600-2.48.F Bound Hinge Arrangement

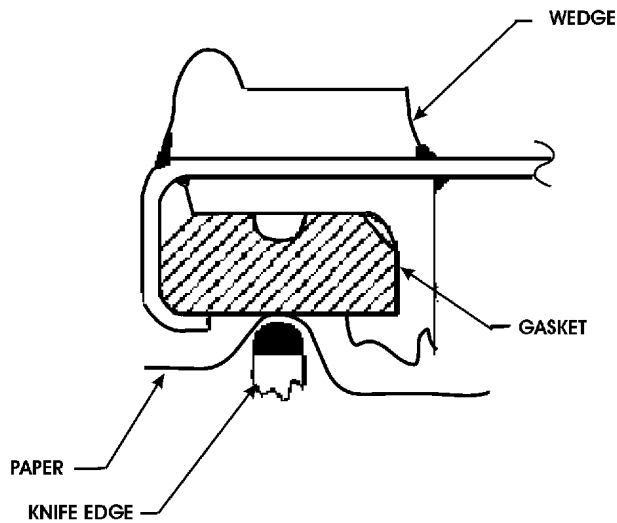


Figure 600-2.48.G Paper Inserted (Wedge side shown, Hinge side similar)

600-2.4.2.3 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 paragraph 600-2.3.2.7 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.

600-2.4.2.3.1 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 600-2.49.) 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.

#### NOTE

Closures equipped with self-lubricated bushings do not need stick packing or string packing. Refer to paragraph 600-2.4.2.3.2 for more information.

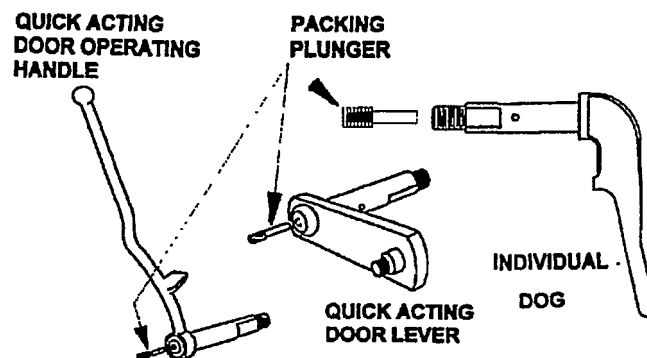


Figure 600-2.49. Packing Plunger Locations

- 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.

600-2.4.2.3.2 Self-Lubricated Bushings (MACHALT 444 - Steel Doors Only)). 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.

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 paragraph [600-2.4.2.5.1](#) for installation instructions for these bushings.

600-2.4.2.3.3 Sintered Bronze Bushings With Elisha Tech EDC 1270 EPL Grease and Cres Paint Shield (MACHALT 526 - 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 [600-2.50](#) and figure [600-2.51](#). 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.

**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.**

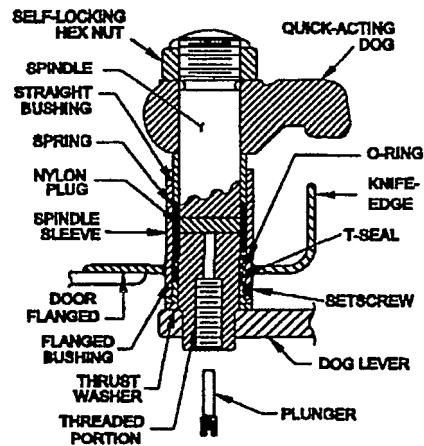


Figure 600-2.50. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31004 (ECP-444)

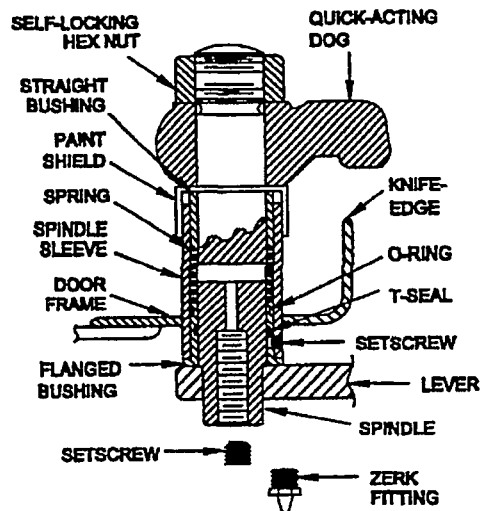


Figure 600-2.51. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- 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.

600-2.4.2.4 Door Disassembly. Damage to the structure or operability of a watertight door can result from warpage to the bulkhead in which it is installed. Another factor that contributes to wear on a watertight door is the weight of the whole door assembly as it swings on its hinges, particularly in high traffic areas. In order to repair problems such as a warped door frame or an inoperable quick-acting dogging assembly, the door must be completely disassembled. In some cases, removal of the door from its hinge assembly is necessary to accomplish the repair. When disassembling a watertight closure to accomplish repairs, inspect all wear parts, such as bushings, and replace as required. If repairing a door to correct for warpage, expect to replace all wear parts (and possibly non-wear parts) because of the excessive strain warpage causes to the door assembly. To disassemble a watertight door, accomplish the following:

- a. For quick-acting doors, completely disassemble the entire operating handle, spindle, lever, and conrod assemblies. See figure 600-2.52, and refer to paragraph 600-2.4.2.6 and paragraph 600-2.4.2.7 for procedures on disassembling operating handles and lever/conrod assemblies. To make reassembly easier, mark each linkage part and its location with a metal etcher. For individually dogged doors, completely disassemble each dog. Refer to paragraph 600-2.4.3.6 for instructions.

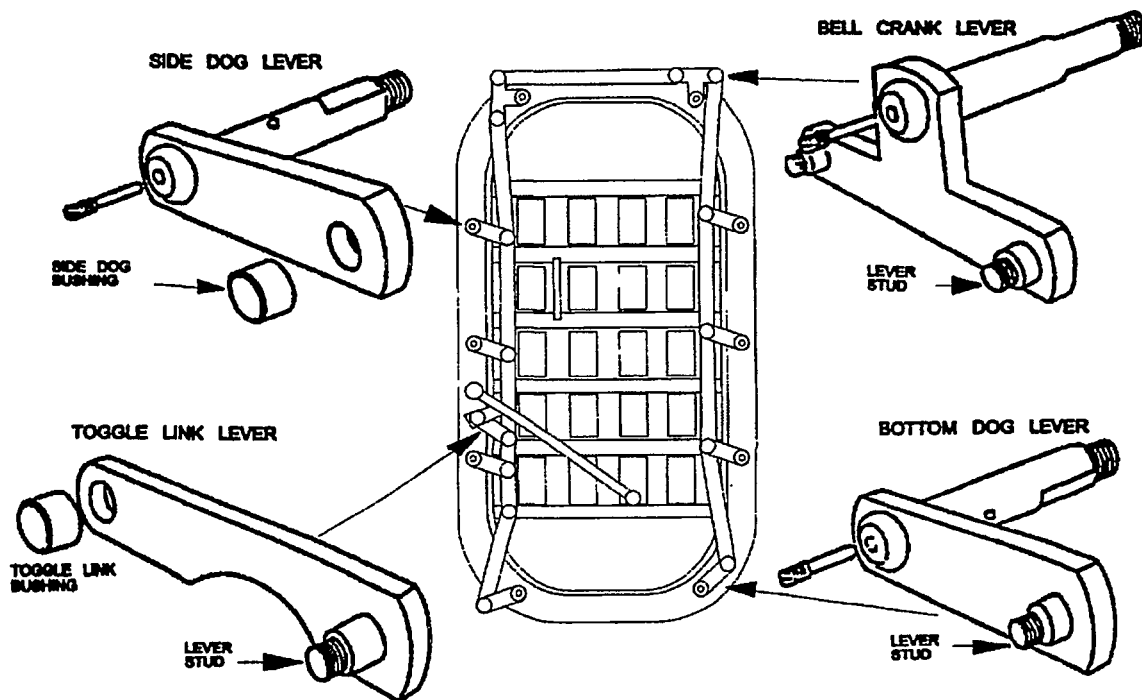


Figure 600-2.52. Quick Acting Door Levers

- b. Flanged bushings on dog assemblies are held in place with Allen head setscrews. Use an Allen wrench to loosen the setscrews. Gently tap out the flanged and straight bushings from all spindle sleeves with a brass rod or pipe approximately 5/8 inch in diameter.
- c. To inspect bushings for wear, insert on a clean spindle of the proper diameter and move back and forth. Bushings should have a firm, uniform fit on the spindle, with no play or wobbling. Replace any bushing that wobbles on the spindle.
- d. To inspect springs for wear, compare with a new spring. Replace any spring that is collapsed or broken, or that has individual coils which are worn thin. New springs are machined with the end coils thinner than those in the center. This is not a sign of wear.

600-2.4.2.5 Spindle Sleeve Preparation and Bushing Installation. Clean and prepare all spindle sleeves of a watertight closure before installing bushings. For ordering replacement bushings, note that spindle bushings and springs for quick-acting doors are 1-inch in diameter. Spindle bushings and springs on individually dogged doors

are 1-1/8 inch in diameter. On some older ships, individually dogged doors have 1-inch diameter spindle bushings, and both the inner and outer bushings are flanged. These older bushings, though obsolete, are still available through watertight door part companies, but are not available through the Navy Supply System. For installation of self-lubricated bushings, refer to paragraph [600-2.4.2.5.1](#) or paragraph [600-2.4.2.5.2](#). To prepare spindle sleeves and install bushings, accomplish the following:

**WARNING**

**Exercise caution when using flammable solvent.**

- a. For steel doors, scrape rust, paint, and old grease from the spindle sleeves using a flat tipped punch and a 1-inch diameter rotary wire brush chucked in an electric drill. A no. 320 grit aluminum oxide cloth can also be used. Remove all rust and corrosion; otherwise, the straight bushing in a dog assembly will not be free to move in the spindle sleeve under spring tension. For all doors, remove all traces of packing with a rag and dry cleaning solvent.
- b. Clean out the setscrew hole in each spindle sleeve with a 12-28UNF tap. Thinly coat the inside of each spindle sleeve with a silicone compound.
- c. Scribe a line on the face of each flanged bushing to indicate the location of the setscrew hole (except for flanged bushings of quick-acting handles). This will make it much easier later to align the hole in the bushing with the setscrew hole in the door sleeve. Thinly coat flanged bushings with a silicone compound, and insert one bushing into each spindle sleeve from the linkage side of the door. Align the hole in each bushing with the setscrew hole in the door sleeve.
- d. Coat the setscrews with antiseize compound. Insert each setscrew into a setscrew hole, and lock the bushing to the sleeve (except for flanged bushings for quick-acting handles). If the setscrew hole is worn out and will not hold a 12-28UNF dog point setscrew, complete the repair in one of the following two ways:
  1. Drill and tap an oversize hole in the sleeve with a no. 7 drill and 1/4-20UNC tap. (Setscrews of this size are available commercially.)
  2. Remove the flanged bushing, and drill and tap a completely new hole somewhere else on the sleeve. Use a no. 14 drill and 12-28UNF tap. Install and rotate the bushing to line up with the new hole.

600-2.4.2.5.1 Self-Lubricated Bushing Installation (MACHALT 444). Oilite phosphor bronze bushings on dog assemblies of steel doors can be replaced with self-lubricated stainless steel bushings that are Teflon coated and have an O-ring mounting. These bushings were recently authorized for new construction; for 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, or authorized machinery alteration (MACHALT). 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. Accomplish the following installation procedure to replace dog assembly bushings with a self-lubricated bushing replacement parts kit.

- a. Remove the existing dog assembly and dog point setscrew. (Refer to paragraph [600-2.4.2.7](#) for quick-acting dog disassembly or paragraph [600-2.4.3.6](#) for individual dog disassembly.) If unable to remove the existing setscrew, drill and tap at the location for the 1/4-20UNC dog point setscrew furnished in the repair parts kit.

**WARNING**

**Exercise caution when using flammable solvent.**

- b. Remove all traces of packing residue from the dog sleeve with a rag and dry cleaning solvent.



- c. Remove corrosion from the interior of the sleeve and ends of sleeve with no. 320 grit aluminum oxide cloth (for steel sleeves). Clean with a rag and solvent.
- d. Clean the spindle of the dog assembly lever or individual dog with a rag and solvent.
- e. Use a soft-faced hammer to install the plastic plug in the transverse hole in the spindle. Do not remove the packing plunger.

**CAUTION**

**Use extreme care when driving the plug with a soft-faced hammer. Lay the spindle on wood or other soft material. Avoid metal-to-metal contact. It may be necessary to use a 1/4-inch or slightly smaller diameter drift punch to drive the plug. Avoid striking the spindle.**

**CAUTION**

**Do not force the bushing or attempt to drive it with a mallet or hammer. The self-lubricated bushing has a Teflon ring that can be easily damaged.**

- f. Apply a thin coat of silicone compound to the interior of the new flanged bushing. Trial fit the bushing to the spindle. The bushing should slide onto the spindle with normal hand pressure.

**CAUTION**

**Do not force the bushing or attempt to drive it with a mallet or hammer.**

- g. Apply a thin coat of silicone compound to the exterior of the flanged bushing. Trial fit the bushing to the dog sleeve. Applying hand pressure, carefully work the flanged bushing into the sleeve.
- h. Apply a thin coat of silicone compound to the inner surface of the dog sleeve on the exterior side (panel side) of the door. Trial fit the straight bushing to the sleeve.
- i. Use the black mark on the edge of the flanged bushing to assist in aligning the hole in the bushing. (It may be necessary to remove the tape that joins the thrust washer to the bushing in order to locate the black mark.) Temporarily tape the washer to the plug. To assist in aligning the bushing mark to the setscrew hole in the sleeve, mark the position of the hole on the outer circumference of the sleeve.

**NOTE**

**Align the bushing mark with the sleeve hole carefully. Since the adhesive/sealant sets up quickly, the hole in the flanged bushing must be in exact alignment with the hole in the dog sleeve.**

- j. Apply a thin coat of adhesive/sealant to the outer edge of the dog sleeve. Immediately work the O-ring into the dog sleeve, and press the flanged bushing to a snug fit with the sleeve.

**WARNING**

**The adhesive/sealant is hazardous material.**

**CAUTION**

**Do not tighten the setscrew.**



- k. Install the CRES dog point setscrew, and rotate the set key one turn.
- l. Apply a thin coat of silicone compound to the lever or dog spindle and to the exterior of the straight bushing. Carefully insert the spindle into the sleeve. Remove the tape holding the thrust washer and the flanged bushing together.
- m. Install the remainder of the dog assembly, except for the second jamnut (if not using self-locking nuts), according to normal procedures. (Refer to paragraph 600-2.4.2.7 for quick-acting dog installation or paragraph 600-2.4.3.6 for individual dog installation.
- n. Apply antiseize compound to the setscrew. Tighten the setscrew to near flush with the surface of the dog sleeve, or until full tightness is achieved. At this point, back off the set key one-half turn.
- o. Repeat step a through step n for each dog assembly.
- p. When all dog assemblies are completed, adjust the dogs and accomplish a chalk test. Refer to paragraph 600-2.4.2.1 for watertight door dog adjustments and to paragraph 600-2.3.2.5 for procedures on accomplishing a chalk test.
- q. After adjustments and a chalk test are completed, install the second jamnut (if not using self-locking nuts). Hold the nut that is already installed with a 1-5/16-inch flat engineer's wrench. Thread the second nut onto the spindle, and tighten it against the first nut with another 1-5/16-inch wrench packing plunger.

600-2.4.2.5.2 Sintered Bronze Bushings With Elisha Technologies EDC 1270 EPL Grade and Cres Paint Shield (MACHALT 526).

#### 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 hexnuts, 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).

600-2.4.2.5.2.1 Quick Acting Watertight Door Modified Dog and Lever Assembly Installation.

- a. Remove setscrew. Clean internal grease passages of spindle using EDC cleaning fluid and cotton tip applicators. Clean internal threads of spindle with a 5/16-24UNF tap, using LPS Tapmatic no. 1 gold as a lubricant. Reinstall setscrew. See figure 600-2.53.

#### CAUTION

**When trial fitting or installing the new flanged bushing, do not force or attempt to drive it onto the spindle or into the spindle sleeve with a mallet or hammer, as flanged bushing O-rings can easily be damaged. The flanged bushing should slide on with normal hand pressure.**

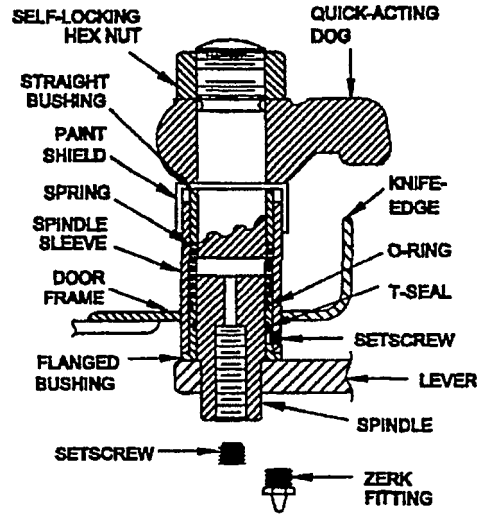


Figure 600-2.53. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

### CAUTION

**Do not allow the threads of the spindle shaft to come in contact with the interior of the flanged bushing or the spindle sleeve.**

- b. Trial fit flanged bushing by applying a thin coat of EDC 1270 EPL grease to the interior of flanged bushing and sliding onto the spindle with normal hand pressure. Then, remove flanged bushing.
- c. Trial fit flanged bushing by applying a thin coat of EDC 1270 EPL grease to the exterior of flanged bushing and sliding into one of the top spindle sleeves with normal hand pressure. Then, remove flanged bushing.
- d. Trial fit straight bushing by applying a thin coat of EDC 1270 EPL grease to the inner surface of spindle sleeve on the outside (panel side) of the door and sliding the straight bushing into the spindle sleeve with normal hand pressure. Then, remove straight bushing.
- e. Align the flanged bushing with the setscrew hole on the spindle sleeve. Work flanged bushing into the spindle sleeve until the flanged bushing is pressed snugly against the spindle sleeve.
- f. Install the setscrew, one turn only, into the hole of spindle sleeve.]
- g. Apply EDC 2400 caulk to the setscrew installed in step (f ). Tighten the setscrew to near flush with the surface of the spindle sleeve, or until tightness is achieved, then back off one-half turn.
- h. Apply a thin coat of EDC 1270 EPL grease to the bell crank lever and spindle. Then, carefully install bell crank lever into the spindle sleeve.

### NOTE

If levers were removed as left- and right-hand assemblies, the levers can be reinstalled as units at this time.

- i. Install compression spring onto spindle shaft.

### CAUTION

**Do not allow the threads of the spindle shaft to come in contact with the interior of the flanged bushing or the spindle sleeve.**

- j. Apply a thin coat of EDC 1270 EPL grease to the exterior of straight bushing, and install bushing onto spindle shaft.
- k. Install paint shield, dog, and self-locking hex nut onto spindle. Tighten the self-locking hex nut just enough to eliminate play.
- l. Repeat step [a](#) through step [k](#) for remaining bell crank lever, bottom dog lever, and side dog lever.
- m. When all dog assemblies are completed, install handle assembly in accordance with paragraph [600-2.4.2.6](#). Adjust dogs in accordance with paragraph [600-2.4.2.2](#) and chalk test in accordance with paragraph [600-2.3.2.5](#).
- n. After adjustments and a chalk test are completed, lubricate dog and handle bushings in accordance with paragraph [600-2.4.2.3.3](#).

#### 600-2.4.2.5.2.2 Oilite Bronze Bushing.

600-2.4.2.6 Operating Handle Replacement. The operating handles of a quick-acting door should work smoothly, without excessive tightness or binding. If handles do not work smoothly, disassemble, clean, and lubricate, then reassemble and adjust. The handles on quick-acting doors wear faster than on other doors because of the strain of operating the entire closing mechanism. Worn, wobbling bushings are another reason to disassemble and repair operating handles. Expect to replace bushings and other wear parts whenever door handles are disassembled for maintenance or repair. Door handles can be disassembled without taking apart other components of the closing mechanism, except for the linkage that connects directly to the handles.

#### 600-2.4.2.6.1 Operating Handle Disassembly.

- a. Place the operating handles in an undogged position.
- b. With the inside handle engaged in the spring clip assembly, remove the cotter pin and conrod collar from the toggle link lever and inside handle.

#### NOTE

Quick-acting doors with MACHALT 167-31010 (ECP-526) installed will have dog point setscrews securing both flanged bushings in the sleeve. The setscrews must be removed prior to removing the bushings.

- c. Remove the jamnuts or self-locking nut from the operating handle shaft.
- d. Withdraw the outside and inside handles from the sleeve. Remove both of the flanged bushings from the sleeve. See figure [600-2.54](#).

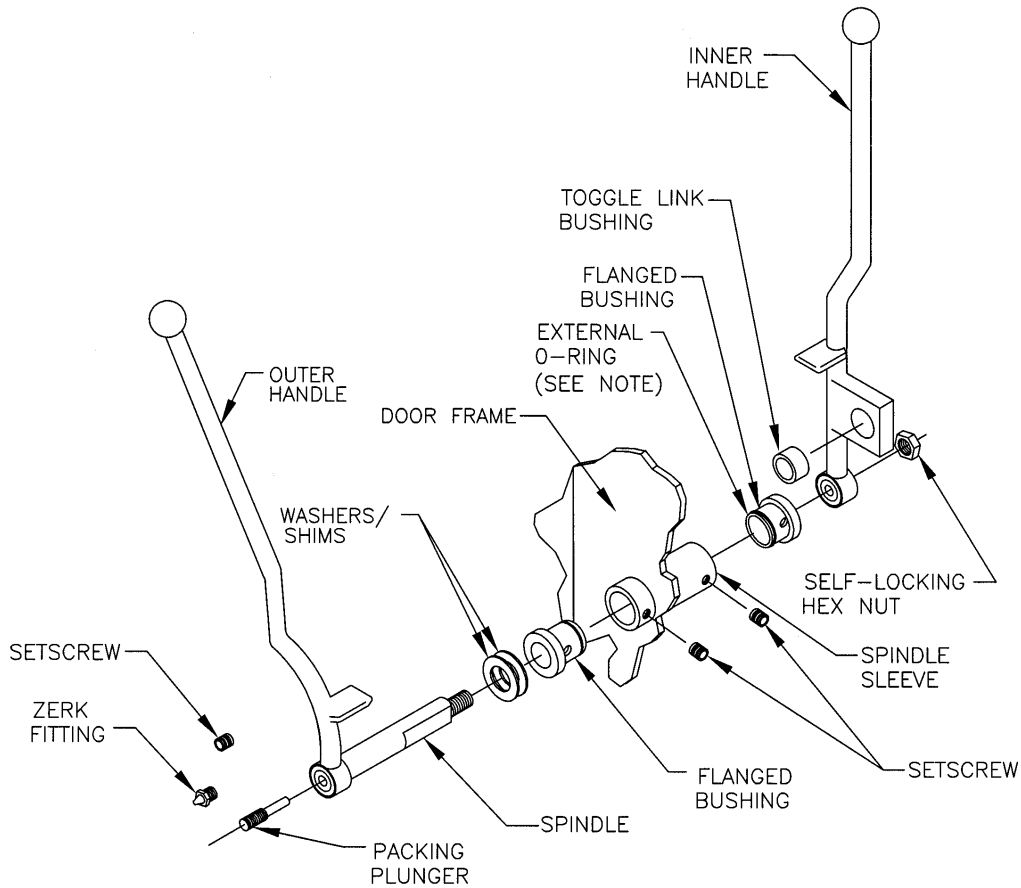


Figure 600-2.54. Quick-Acting Operating Handle Assembly (Left-Hand Shown)

600-2.4.2.6.2 Operating Handle Repair and Replacement. To repair or replace the operating handles of a quick-acting steel watertight door, accomplish the following:

- a. Remove the packing plunger from the outer handle spindle. Discard the packing plunger if it has a damaged screwdriver slot or threads. If the internal thread on the spindle is damaged, it can be retapped with a 5/16-24UNF tap. Remove the chips from the hole with a scribe and cotton swab. (This step is not necessary where self-lubricated bushings are either existing or being installed new.)
- b. Examine the spindle bearing surfaces of each handle. If the bearing surfaces have deep scratches or grooves, the handle must be replaced. If the spindle threads are damaged, repair them with a 7/8-9UNC die. The fit between the spindle and the hole in the inner operating handle is sometimes so loose that the hole becomes enlarged and excessive movement develops. The result of this problem is that the interior and exterior handles become misaligned by as much as 30 degrees, preventing rapid operation of the door. To correct this problem, accomplish a temporary repair in accordance with figure 600-2.55. This consists of installing a grooved 1/8-inch roll pin in a hole drilled through the operating handle and the handle shaft. The handle and shaft must be drilled as an assembly to ensure correct alignment of the holes. The pin will hold the handle and shaft rigidly together, but can be removed if necessary for maintenance purposes.

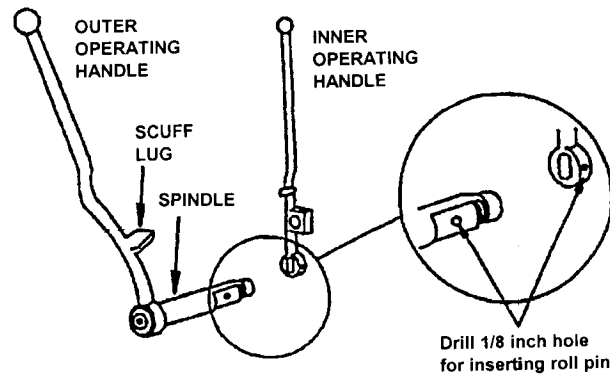


Figure 600-2.55. Quick-Acting Operating Handle Temporary Repair

**WARNING**

**Exercise caution when using flammable solvent.**

- c. For steel doors, remove corrosion from the interior and ends of the sleeve with no. 320 grit aluminum oxide cloth. Clean with a rag and dry cleaning solvent.

**NOTE**

For exterior or well deck doors having MACHALT 167-31010 (ECP-526) installed, proceed to paragraph 600-2.4.2.6.3.

**CAUTION**

**Do not sand or paint bearing surfaces.**

**CAUTION**

**Do not sand and paint parts that are made of CRES. An easy way to differentiate between plated steel and CRES is with a magnet. Plated steel will attract the magnet; stainless steel will not.**

- d. Scrape, sand, and paint individual linkage parts if required. Use Formula 150 primer. Clean parts with a rag and solvent.
- e. When using a self-lubricated bushing replacement parts kit, install the plastic plug that is supplied with the kit into the transverse hole in the hand lever shaft.

**CAUTION**

**Use extreme care when driving the plug with a hammer. Lay the shaft on wood or other soft material. Avoid metal-to-metal contact. It may be necessary to use a 1/4-inch or slightly smaller diameter drift pin to drive the plug. Avoid striking the shaft, and do not remove the packing plunger.**

- f. Apply a thin coat of silicone compound to the interior of the flanged bushings.

**CAUTION**

**If replacing the bushings with self-lubricated ones, trial fit the new bushings to the hand lever shaft. Do not attempt to force the bushings or drive the bushings with a mallet or hammer. The self-lubricated bushing has a Teflon seal ring that can easily be damaged. The bushing should slide onto the shaft with normal hand pressure.**

- g. Apply a thin coat of silicone compound to the inner surface of the operating handle sleeve and both ends of the sleeve. Install the flanged bushings into the sleeve.

**CAUTION**

**Do not allow the threads of the shaft to come into contact with the interior of the bushing.**

- h. Apply silicone compound to the spindle of the outer operating handle. Insert the outside operating handle in the flanged bushing. When installing new outside operating handle, ensure that proper amount of washers/shims (supplied with handle) are used to allow scuff lug on handle to slide across scuff plate on door panel. Too few washers/shims will result in scuff lug gouging door panel edge; and too many will result in scuff lug not contacting scuff plate when dogging door.
- i. From the inside of the door, wrap 12 inches of string packing around the outer handle spindle and push the string packing into the spindle sleeve with a screwdriver.
- j. Apply hand pressure to the other flanged bushing, and carefully guide the operating handle shaft through the bushing. Avoid thread contact with the inner surface of the bushing.
- k. Install the inside handle and connect the toggle link.
- l. Thread the conrod collar onto the toggle link lever stud. Do not tighten.
- m. Install one jamnut or self-locking nut. Tighten the nut just enough to engage three threads. Do not install a second jamnut at this time. If using jamnuts, install the second jamnut only after all assembly/adjustments and a chalk test are completed. Refer to paragraph [600-2.4.2.2](#) for watertight door dog adjustments and to paragraph [600-2.3.2.5](#) for procedures on accomplishing a chalk test.
- n. Tighten the conrod collar to the proper position, and install the cotter pin. Spread and bend the ends of the cotter pin.
- o. Insert a packing plunger into the handle spindle. (Do not use stick packing when installing self-lubricated bushings.)

600-2.4.2.6.3 Operating Handle Bushing Replacement - Sintered Bronze Bushings With Elisha Technologies EDC 1270 EPL Grease (MACHALT 167-31010 (ECP-526)).

**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).

- a. Remove packing plunger. Clean internal grease passages of spindle using EDC cleaning fluid and cotton tip applicators. Clean outer handle internal threads for packing plunger with a 5/16-24UNF tap, using LPS Tap-matic no. 1 gold as a lubricant. Install zerk fitting.
- b. Remove and discard the external O-ring from flanged bushing to be installed on the inner handle side of spindle sleeve.
- c. Drill and tap two (2) 12-28UNF holes in the operating handle sleeve. Each hole shall be located 0.25 inches from each end of the sleeve.

### CAUTION

**When trial fitting or installing the new flanged bushing, do not force or attempt to drive bushing onto the spindle or into the spindle sleeve with a mallet or hammer, as flanged bushing O-rings can easily be damaged. The flanged bushing should slide on with normal hand pressure.**

- d. Trial fit both flanged bushings by applying a thin coat of EDC 1270 EPL grease to the interior of flanged bushings and slide them onto the spindle with normal hand pressure. Then, remove flanged bushings.
- e. Apply a thin coat of EDC 1270 EPL grease to the exterior and face surface of both flanged bushings, and slide one into each end of the spindle sleeve with normal hand pressure. Align the flanged bushings with the set-screw holes on the spindle sleeve. Leave flanged bushings in spindle sleeve. Install the setscrews, one turn only, into the spindle sleeve holes.
- f. Apply EDC 2400 caulk to setscrews installed in step (e). Tighten setscrews to near flush with the inside surface of the spindle sleeve bushings.
- g. Apply a thin coat of EDC 1270 EPL grease to the spindle of the outer handle.

### CAUTION

**To prevent damage to O-rings, do not allow the threads of the spindle to come in contact with the interior of the flanged bushings.**

- h. Apply hand pressure to flanged bushings on the inside of door, and carefully guide the outer handle spindle into spindle sleeve and through flanged bushings.
- i. Install the inner handle, and engage in the spring clip assembly.
- j. Install toggle link lever to inner handle.
- k. Install the conrod collar over toggle link lever stud. Do not tighten.
- l. Install self-locking hex nut, and tighten just enough to eliminate play.
- m. Install washers, conrod bushings, and the conrods.
- n. Install conrod collar and cotter pins.
- o. Adjust dogs, as required, to provide 1/8-inch gasket compression in accordance with paragraph [600-2.4.2.2](#).
- p. Accomplish chalk test procedure in accordance with paragraph [600-2.3.2.5](#).
- q. Use grease gun to apply EDC 1270 EPL grease to zerk fitting until a small amount of EDC 1270 EPL grease comes out of the flanged bushings. Remove grease gun and zerk fitting, and install setscrew with EDC 2400 caulk.

**600-2.4.2.7 Conrod and Lever Disassembly and Repair.** This section provides the procedures for disassembling and repairing the components of a quick-acting watertight door closure assembly. A complete disassembly is necessary if the connecting rod (conrod) and lever assembly is frozen or does not operate properly. To disassemble the linkages:

600-2.4.2.7.1 Conrod Disassembly.

- a. Remove the cotter pin, conrod collar (round nut), conrod, and washer from each conrod linkage. See figure 600-2.56, figure 600-2.57, and figure 600-2.58.

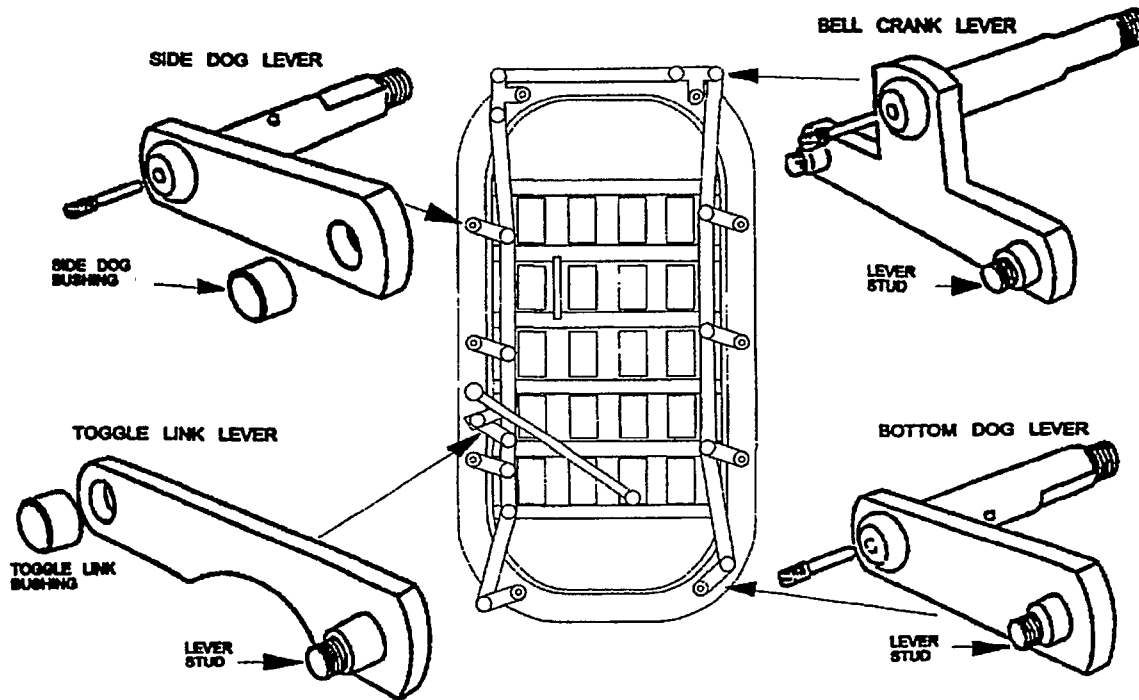


Figure 600-2.56. Quick Acting Door Levers

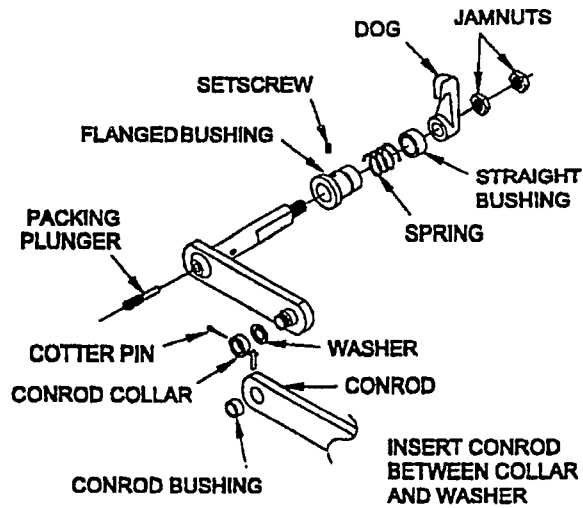


Figure 600-2.57. Quick-Acting Door Lever Assembly



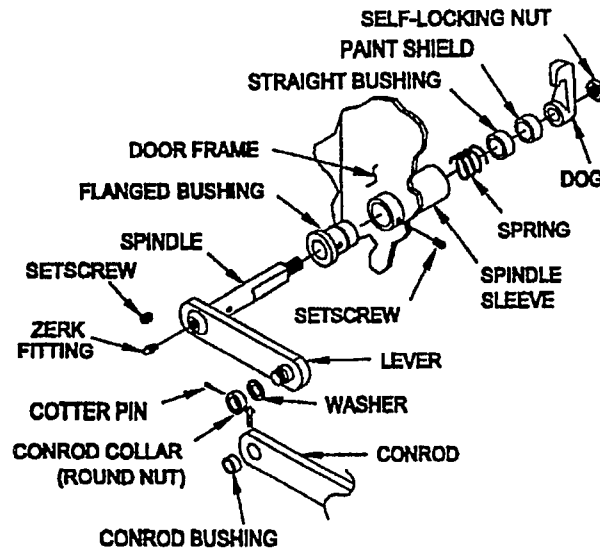


Figure 600-2.58. Quick-Acting Door Lever Assembly Modified by MACHALT 167-31010 (ECP-526)

- b. Remove the conrods from the lever assemblies. For easier reassembly, mark each conrod and its location with a metal etcher.

#### 600-2.4.2.7.2 Lever Disassembly.

- a. For each dog and lever assembly, remove the self-locking hex nut (or two jamnuts) and the rotating dog from the outside of the door.
- b. Remove the paint shield (if applicable), straight bushings, and compression springs from the spindle sleeves.
- c. Remove the levers from the spindle sleeves. Mark each lever and its location for easier reassembly.
- d. Use an Allen wrench to loosen the setscrew on the flanged bushings. Remove the flanged bushings from the spindle sleeves.

#### 600-2.4.2.7.3 Conrod Repair.

- a. Examine each conrod for wear. Replace any conrod that shows excessive wear or deformation of holes. Conrods and levers are available commercially in either mild steel or CRES, which eases the maintenance required on weather deck doors.
- b. Examine all conrod bushings for wear. Remove any bushing that has excessive wear with a large flat tipped punch or the special removal tool illustrated in figure 600-2.59. This tool can be easily fabricated on a metal lathe. Use a vice to hold the conrod while the bushing is forced out of the hole.

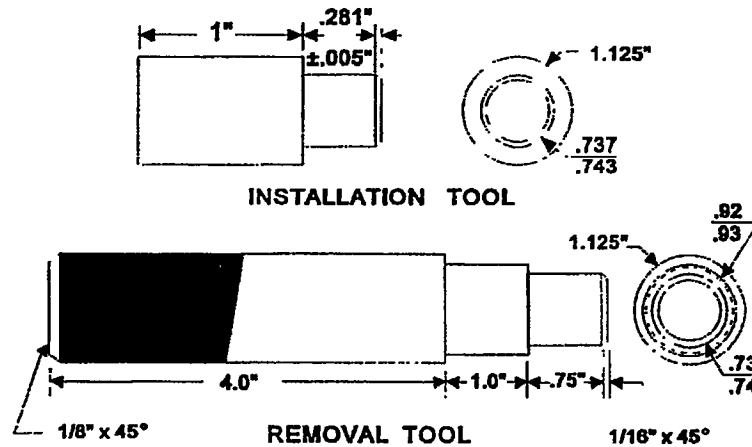


Figure 600-2.59. Conrod Removal and Installation Tool

- c. Examine all studs, which are the threaded posts on each conrod and lever. A stud that is loose or has worn bearing surfaces must be replaced. For ships with access to a hydraulic press, the preferred method for replacing studs is by swaging the stud to the conrod or lever. Welding is only permitted as a temporary repair for loose studs. Be sure to use a replacement stud of the exact same length as the old one. To replace a stud:
1. Swaging Method:
    - (a) Drill the stud 3/16-inch deep from the back side with a 1/2-inch cobalt drill bit.
    - (b) Drive the pin through the hole with a 3/8-inch drive pin punch.
    - (c) Use a swaging tool with a hydraulic press to insert the stud into the hole.
  2. Welding Method: (Not permitted; use only for temporary repair.)
    - (a) Drill the stud 3/16-inch deep from the back side with a 1/2-inch cobalt drill bit.
    - (b) Drive the pin through the hole with a 3/8-inch drive pin punch.
    - (c) Insert the new stud in the hole, and clamp it tightly in place using a pair of welder's vice grip style clamps. Ensure the stud is straight and not cocked in any way.
    - (d) Ring weld the stud to the conrod or lever using a 3/32-inch alloy 300 series stainless steel electrode. Gas tungsten arc welding (GTAW) with 1/16 wire is also acceptable.
    - (e) Grind the weld to dime thickness.
- d. Chase stud threads with a 5/8-18UNF thread chaser, if necessary. The threads on the brass conrod collars can be chased with a 5/8-18UNF tap while holding the shank of the tap in a vice. Handthread the conrod collar onto the tap. A 1/8-inch diameter welding rod stub inserted into one of the cotter pin holes in the nut makes it easier to turn the conrod collar. Do not use pliers or a pipe wrench, which will mar the polished surface of the nut.

**CAUTION**

**Do not sand or paint bearing surfaces.**

**CAUTION**

**Do not sand and paint parts that are made of CRES. An easy way to differentiate between plated steel and CRES is with a magnet. Plated steel will attract the magnet; stainless steel will not.**

- e. Scrape, sand, and paint all of the individual linkage parts, if required. Use Formula 150 primer and Formula 151 top coat.

- f. Replace conrod bushings if wear is apparent or if the closure linkages allow a play of more than 1/8-inch when inspected. (Refer to paragraph [600-2.3.2.10](#).) The following three different size bushings are generally used on quick-acting doors:
1. 5/8-inch thick operating handle and toggle link bushings.
  2. 1/2-inch thick lever bushings.
  3. 3/8-inch thick conrod bushings.
- g. Install the conrod bushings by pressing into place with a vise or with the use of the special installation tool illustrated in figure [600-2.59](#). Using this tool along with the vise helps hold the bushing in proper alignment with the conrod while the bushing is pressed into place.

#### 600-2.4.2.7.4 Lever Repair.

- a. Examine each lever for wear. Replace any lever that has deep scratches or grooves worn into the bearing surfaces.
- b. Examine all studs, which are the threaded posts on each conrod and lever. A stud that is loose or has worn bearing surfaces must be replaced. Refer to paragraph [600-2.4.2.7.3](#) for procedures on repairing and replacing studs.
- c. Chase the threads of lever spindles with a 7/8-9UNC die, if necessary.

#### NOTE

Step d is not required where self-lubricated bushings are installed.

- d. Remove the packing plungers from all lever spindles. Discard packing plungers that have damaged screw-driver slots or threads. If the internal thread on a spindle is damaged, it can be retapped with a 5/16-24UNF tap. Remove the chips from the hole with a scribe and cotton swab. Replace the packing plungers.

#### CAUTION

**Do not sand or paint bearing surfaces.**

#### CAUTION

**Do not sand and paint parts that are made of CRES. An easy way to differentiate between plated steel and CRES is with a magnet. Plated steel will attract the magnet; stainless steel will not.**

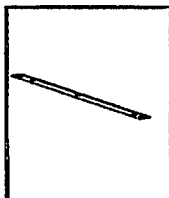
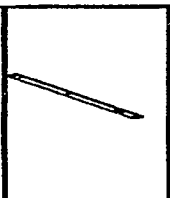
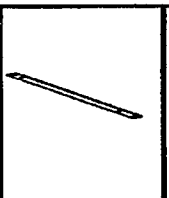
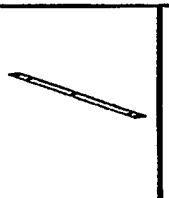
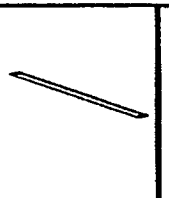

- e. Scrape, sand, and paint all of the individual linkage parts, if required. Use Formula 150 primer and Formula 151 top coat.

600-2.4.2.7.5 Lever Installation. Prepare spindle sleeves and assemble bushing in each sleeve, as described in paragraph [600-2.4.2.5](#).

600-2.4.2.7.6 Conrod Installation. When replacing conrods with new parts, be aware that all top conrods for quick-acting watertight doors (26 inches wide) are identical. However, the distance between centers of opposing bellcrank connecting studs may vary as much as 1/2 inch. Conrods obtained commercially have one bushing inserted. The other conrod bushing is attached. To install conrods, accomplish the following:

- a. Apply a light coat of silicone compound to the conrod bushings and the bearing surfaces of all studs. Coat the stud threads with antiseize compound.
- b. Use the identifying marks previously made on conrods in paragraph [600-2.4.2.7.1](#) to locate the correct posi-

tion for each conrod. Also see figure [600-2.60](#). Insert one washer on each stud between the conrod and lever components at each linkage connection.

						
	<b>CONROD LEVER SIDE</b>	<b>CONROD LEVER SIDE</b>	<b>CONROD HINGE SIDE</b>	<b>CONROD HINGE SIDE</b>	<b>CONROD TOP</b>	<b>CONROD CORNER</b>
<b>RH 8-DOG</b>	<b>R</b>	<b>-</b>	<b>Z</b>	<b>-</b>	<b>D</b>	<b>E</b>
<b>LH 8-DOG</b>	<b>X</b>	<b>-</b>	<b>H</b>	<b>-</b>	<b>D</b>	<b>E</b>
<b>RH 10-DOG</b>	<b>-</b>	<b>W</b>	<b>-</b>	<b>Q</b>	<b>D</b>	<b>C</b>
<b>LH 10-DOG</b>	<b>-</b>	<b>K</b>	<b>-</b>	<b>B</b>	<b>C</b>	<b>-</b>

**NOTE:** Matched letters indicate that these parts are interchangeable.

Figure 600-2.60. Conrod Location Guide

- c. Attach a brass conrod collar (round nut) to each linkage connection. Handtighten only.
- d. At each stud, align the hole in the conrod collar with the hole drilled into the stud. Insert a cotter pin and bend over both legs of the cotter pin with needle nose pliers.

600-2.4.2.8 Watertight and Airtight Door Hinge Repair. Due to more frequent use, quick-acting watertight doors are more likely to experience wear to hinge assemblies than individually dogged doors. Refer to paragraph [600-2.3.2](#) for conditions that require repair or replacement of hinge pins and hinge assemblies. Repairs to a watertight door hinge assembly can be accomplished without disassembling any of the closure mechanism. Review the safety procedures described in chapter 2, paragraph [2-1](#), before starting repair work to door hinges.

600-2-4.2.8.1 Disassembly and Repair of Hinge Assemblies (On Doors Without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed). To disassemble and repair hinge assemblies, accomplish the following:

- a. With a hammer and chisel, knock the hinge pin collars off the bottom of the hinge pins. See figure [600-2.61](#).

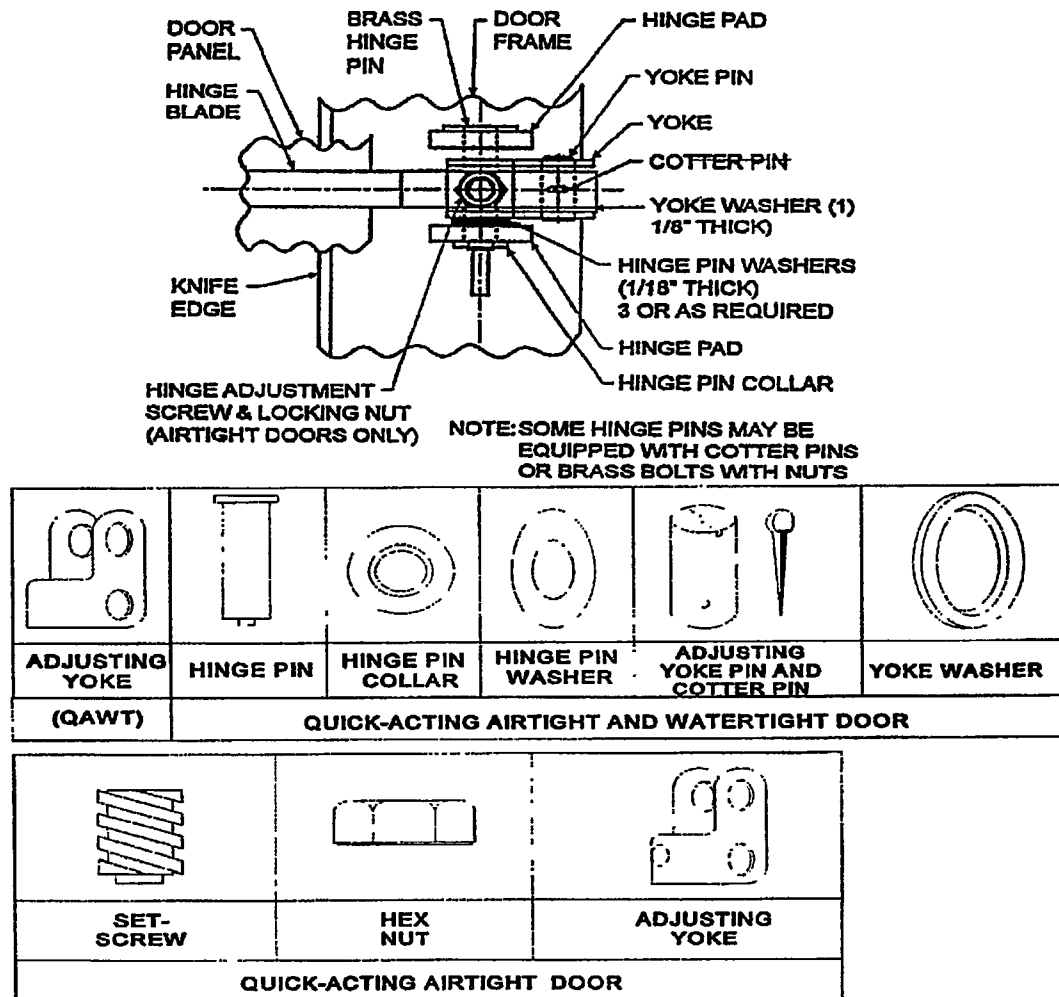


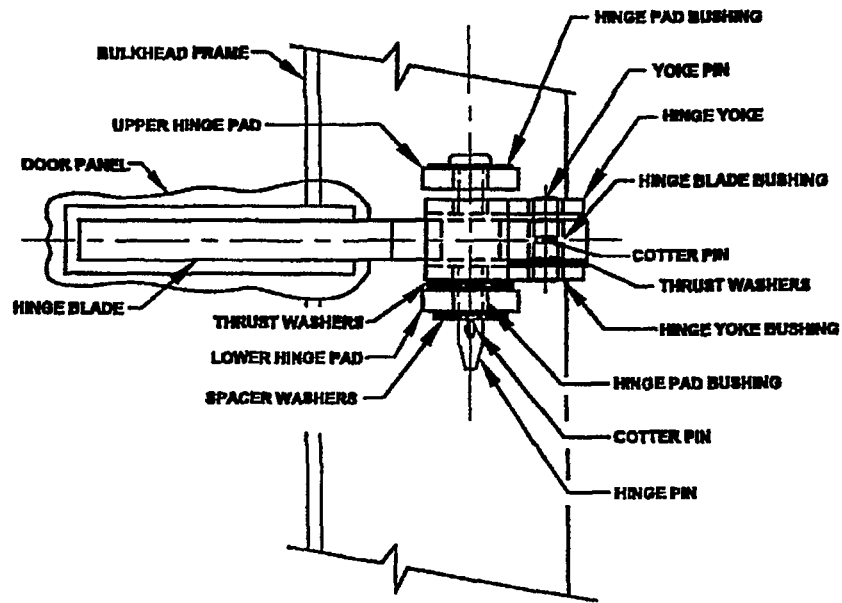
Figure 600-2.61. Watertight Door Hinge Components (For Doors Without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed)

- b. Use a flat tipped drift punch to drive out the hinge pins, If the hinge pins are badly worn, have another person pick up the door from the bottom and rock it back and forth while the pins are driven out. The rocking action tends to pull the grooves that are worn into the shank away from the other steel hinge parts, allowing easier removal. Set the door panel aside, with the hinge side up.
- c. Disassemble the adjusting pin and yoke of each hinge assembly. On quick-acting airtight doors, the adjusting yoke has a setscrew and hex nut fitted to the front side. This yoke is used to push the hinge side of the door and gasket up against the knife-edge, since there are no dogs on the hinge side of the airtight door for this purpose.
- d. Examine the hinge parts for excessive wear, and clean the parts or procure replacement parts as required. Brass hinge pins are recommended over stainless steel, and if stainless steel hinge pins are found they should be replaced with brass hinge pins to avoid undue wear to hinge yokes.
- e. Reassemble the adjusting yokes and pins onto the door hinge blades. Be sure to insert a 1/8-inch thick brass flat washer on top of the bottom adjusting yoke blade before inserting the adjusting pin and cotter pin.
- f. Set the door in the frame.
- g. Place three 1/16-inch thick brass flat washers between the top of the hinge blade and the lower adjusting yoke leaf. Insert the hinge pins.

- h. Close and dog the door. Ensure the knife-edge sits in the center three-fifths of the width of the door gasket at the top and bottom. There should be no contact between the metal on the door gasket channel and the knife-edge. If there is metal-to-metal contact, shim the door up or down by adding or removing one 1/16-inch washer from each hinge. See figure [600-2.62](#).
- i. To lock the hinge pin to the collar, have someone hold a sledge hammer over the top of each hinge pin while the collar is inserted, bevel side down, over the boss on the bottom of the hinge pin. Peen over the boss with the rounded end of a ball peen hammer to lock the collar to the hinge pin. The weight of the sledge hammer resting on top of the hinge pin keeps the pin from backing out as the boss is peened over.

600-2-4.2.8.2 Disassembly and Repair of Hinge Assemblies (On Doors With MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed).

- a. Remove cotter pins, spacer washers, hinge pins, and thrust washers. See figure 2-2.62. Set the door panel aside with the hinge side up.
- b. Remove cotter pins, yoke pins, hinge yoke, thrust washers, and hinge pin spacer from each hinge assembly.
- c. Clean the hinge parts and examine for excessive wear. Procure replacement parts as required.
- d. Apply a thin film of quick forming adhesive to the outside diameter surface of the hinge pad bushings, ensuring no adhesive comes in contact with the inside diameter.



<b>HINGE PIN &amp; COTTER PIN</b>	<b>YOKE PIN &amp; COTTER PIN</b>	<b>HINGE YOKE</b>	<b>HINGE PAD BUSHING</b>
<b>HINGE BLADE BUSHING</b>	<b>HINGE YOKE BUSHING</b>	<b>SPACER BUSHING</b>	<b>THRUST WASHER</b>
<b>QUICK-ACTING AIRTIGHT AND WATERTIGHT DOORS</b>			

Figure 600-2.62. Watertight Door Hinge Components (For Doors With MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed)

- e. Install hinge pad bushings into the upper and lower hinge pads and, if necessary, gently tap into upper and lower hinge pads.
- f. Temporarily install hinge pins while adhesive is forming in order to align hinge pad bushings. Remove hinge pins after adhesive is formed.
- g. Insert yoke pin spacer into the yoke pin hole in the hinge blade. Align cotter pin holes of the yoke pin spacer with the cotter pin holes of the hinge blades. Position hinge yoke assembly on hinge blade, and partially insert yoke pin with slotted end up.
- h. Install two thrust washers between the bottom of hinge blades and the hinge yoke assemblies. Align thrust washers and fully insert yoke pins. Align cotter pin holes in hinge blades, hinge yoke assemblies, and yoke pins, and install cotter pins. Ensure hinge yoke assemblies rotate freely around the yoke pins.
- i. Position door upright and resting on deck close to hinge pads. Partially rotate hinge yokes away from hinge pinholes in hinge blades. Insert hinge pin spacers in holes of hinge blades. Then, rotate hinge yoke assemblies back into position over the hinge pinholes in the hinge blades, ensuring hinge pin spacers remain in place and upright.

- j. Lift door into position on the hinge pads, and insert hinge pins through the hinge pads, hinge yokes, and spacer bushings. With one person supporting the door on the handle side, pry upward on the underside of the hinge blades and lower hinge pads with a long flat tipped screwdriver. Lift the hinge pins enough to insert two thrust washers between the hinge yokes and the lower hinge pad bushings. Center thrust washers, and fully insert hinge pins.
- k. Install spacer washers and cotter pins into hinge pins.
- l. Close and dog the door. Ensure the knife-edge sits in the center three-fifths of the width of the door gasket at the top and bottom. There should be no contact between the metal on the door gasket channel and the knife-edge. If there is metal-to-metal contact, shim the door up or down by adding or removing one 1/16-inch thrust washer from each hinge. See figure 600-2.62.

600-2.4.2.9 Dog Wedge Replacement. Dog wedge must be replaced if it is worn more than halfway down, or if it has deep grooves carved into it or other signs of excessive wear or damage. The wedge may be either welded, riveted, or bolted in place with machine screws. See figure 600-2.63, and accomplish the procedure in paragraph 600-2.4.2.9.1, paragraph 600-2.4.2.9.2 or paragraph 600-2.4.2.9.3, as applicable.

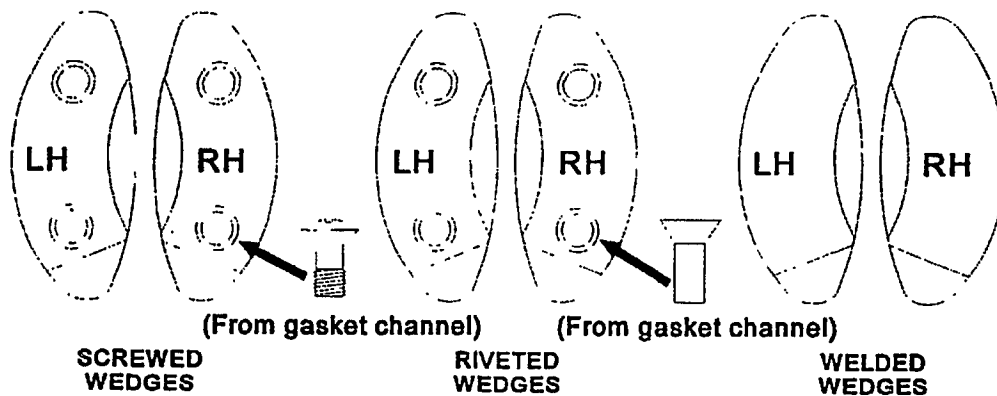


Figure 600-2.63. Dog Wedges

#### 600-2.4.2.9.1 Replacement of Welded Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.
- b. Remove the damaged wedge with a portable grinder.
- c. Position the new wedge exactly over the position of the old wedge.
- d. Weld the new wedge in place using the GTAW (tungsten inert gas (TIG)) or shielded metal arc welding (SMAW, metal inert gas (MIG)) welding process. Welding electrodes must conform to MIL-E-278, aluminum bronze, MIL-E-CU/AL-A, for SMAW welding or MIL-E-23765/3, aluminum bronze, CUAL-A2, for GTAW (TIG) welding.
- e. Reinstall the door, washers, hinge pins, and gasket.
- f. Adjust the door as required. Refer to paragraph 600-2.4.2 for procedures on making adjustments.

#### 600-2.4.2.9.2 Replacement of Riveted Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.
- b. Remove the damaged wedge by drilling out the center of the rivet using a hammer and center punch.
- c. Use a nylon scrubbing pad to clean the area under the wedge.
- d. Use Formula 150 primer on the area under the wedge.



- e. Install dielectric barrier on the area under the wedge.
- f. Position the new wedge exactly over the position of the old wedge. Rivet the wedge into place.
- g. Reinstall the door, washers, hinge pins, and gasket.
- h. Adjust the door as required. Refer to paragraph [600-2.4.2](#) for procedures on making adjustments.

#### 600-2.4.2.9.3 Replacement of Machine Screwed Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.
- b. Remove the damaged wedge by removing the 5/16-24UNC machine screws.
- c. Use a nylon scrubbing pad to clean the area under the wedge.
- d. Use Formula 150 primer on the area under the wedge.
- e. Install a dielectric barrier on the area under the wedge.
- f. Position the new wedge exactly over the position of the old wedge. Use 5/16-24UNC machine screws to bolt the wedge into place.
- g. Reinstall the door, washers, hinge pins, and gasket.
- h. Adjust the door as required. Refer to paragraph [600-2.4.2](#) for procedures on making adjustments.

**600-2.4.2.10 Door Handle Spring Clips.** Quick-acting watertight doors have a bronze spring clip fastened to the inside of the door frame to hold the handle upright when the door is open. Individually dogged doors have a spring clip assembly for each dogging handle. Over time, the spring clip may snap off due to metal fatigue. To replace a spring clip assembly, accomplish the following:

- a. Remove the two screws holding the clip to the tab that is welded to the door frame. Use an offset screwdriver to gain access to the screw heads. If the screws are frozen and impossible to remove, chisel the screw heads off flush with the surface. Redrill the holes with a no. 21 drill, and tap the holes with a 10-32UNF tap.
- b. Spring clip assemblies come in two different styles. See figure [600-2.64](#). The center-to-center distance between screw holes on newer doors is 1/2-inch. On older doors, the distance between screw holes is 11/16-inch. If the holes on the new spring clip do not match the holes on the door, it will be necessary to drill a new hole in the mounting tab welded to the door. Mark the new hole location with a small center punch. Drill the new hole with a no. 21 drill, and tap with a 10-32UNF tap. Screw on the new spring clip.



Figure 600-2.64. Spring Clip Assemblies

### 600-2.4.3 Individually Dogged Watertight/Airtight Doors.

600-2.4.3.1 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.**

#### **NOTE**

If replacing gasket, accomplish dog adjustment procedures before installing new gasket.

Inspection procedures for watertight closure gaskets are provided in paragraph [600-2.3.2.4](#). If a gasket fails the inspection, accomplish the procedures in paragraph [600-2.4.3.1.1](#) through [600-2.4.3.1.2](#). Accomplish any dog adjustments before installing a new gasket.

#### 600-2.4.3.1.1 Gasket 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 [600-2.65](#)

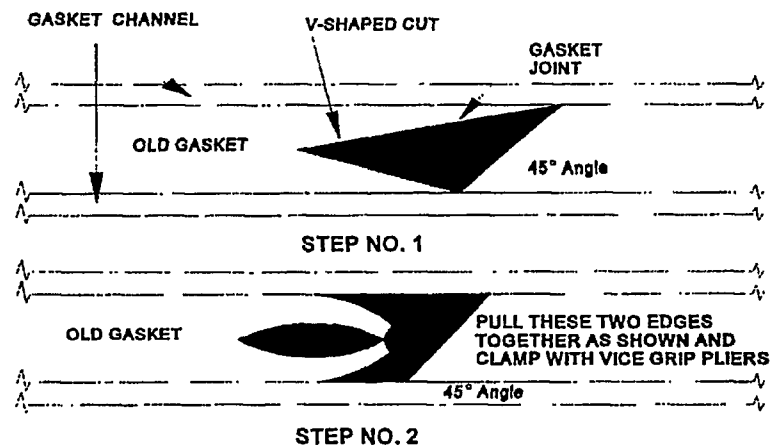


Figure 600-2.65. Gasket Removal

**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.

600-2.4.3.1.2 Installation of ZZ-R-765 Silicone Gasket. The ZZ-R-765 Silicone, Class 3B, 30 Durometer, is authorized for all watertight closures except ballistic closures.

**NOTE**

Accomplish dog adjustment procedures in para.600–2.4.3.2.1 **before** installing new gasket. (Adjusting the dogs without the gasket installed is more accurate than adjusting the dogs with the gasket installed.)

**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.

600-2.4.3.2 Individually Dogged Watertight/Airtight 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 600-2.4.3.2.1) has proven to be the most accurate. However, this procedure must be accomplished with the gasket removed. Method 2 (refer to paragraph 600-2.4.3.2.2) 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.

600-2.4.3.2.1 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 and dog the door.
- 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 600-2.66.
- f. Where jamnuts are used, tighten the second jamnut securely against the first jamnut.

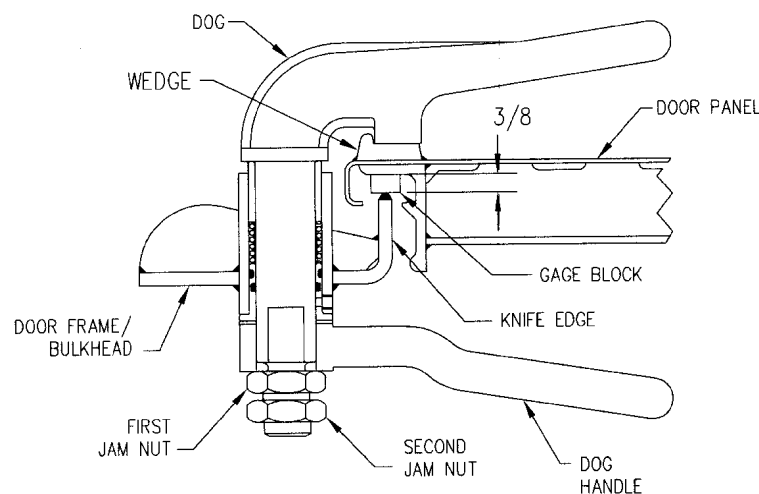


Figure 600-2.66. Dog Adjustment Without Gasket Installed

- 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.

600-2.4.3.2.2 Individually Dogged Watertight Door (with gasket installed) Dog Adjustment Method 2. This procedure, when followed, will ensure proper adjustment of the dogs and hinges on a quick acting airtight door to provide the required 1/8" gasket compression when in the fully dogged position.

#### NOTE

Two persons are required for this procedure; one person posted on each side of the door. Read all steps in this procedure before beginning! Prior to performing any adjustment, ensure all hinge components are properly installed, free of wear, hinge yokes move freely, and there is no metal to metal contact between the knife-edge and gasket channel (see figure 600-2.66A) when the door is in the dogged position. If metal-to-metal contact is present, the quantity of hinge washers may need to be adjusted. If metal-to-metal contact cannot be corrected by adjusting the quantity of hinge washers, initiate action to repair (i.e. remove & relocate hinge pads) or replace door.

Tools and material required:

Wrench, adjustable, 14"

Wrench, engineers, open end, 1-5/16"

Chalk

Rags

Paper, strip 3" x 11"

Marker, felt tip

Cloth, abrasive, 320 grit

600-2.4.3.2.2.1 Dog Adjustment Procedure .

- a. While positioned on the inside of the door, close and fully dog the door.
- b. Loosen all self-locking dog spindle nuts (see figure 600-2.66A) or jam nuts (see figure 600-2.66B) until all dogs and wedges located on the outside of the door are clearly separated.
- c. Un-dog and open the door.
- d. Using a rag, clean the knife-edge and gasket. If paint is present on knife-edge, remove using 320 grit abrasive cloth. Apply chalk to the gasket contact surface of the knife-edge.
- e. Close the door lightly but do not dog. Push firmly against the outside of the door panel at the center to obtain a chalk imprint on the gasket.
- f. Open the door and examine the gasket to determine where the chalk transferred from the knife-edge to the gasket. Gasket areas without chalk indicate the knife-edge and gasket did not make contact when the door was closed.

**NOTE**

If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again.

- g. To aid in the dog adjustment sequence, mark with chalk on the inside of the door panel, the dogs in the areas where the gasket contacted the knife-edge. These are the areas where dog adjustment shall be accomplished first.

**NOTE**

A continuous transfer of chalk indicates the door panel and frame are very straight, and dog adjustment may begin. An imprint of less than 50% indicates the panel or frame is warped and action should be initiated to replace the closure.

**NOTE**

Perform steps (h) through (l) beginning with the dogs closest to areas where gasket made contact with the knife-edge and end with dogs where the gasket did not contact the knife-edge.

**NOTE**

**DO NOT LEAN AGAINST THE PANEL DURING THE ADJUSTMENT PROCEDURE**

- h. Insert a strip of paper between the gasket and knife-edge in the immediate area of the dog. Close and dog the door (see figure 600-2.66C).
- i. Tighten the self-locking dog spindle nut (or first jam nut) until the paper cannot be pulled out. If the paper is held tightly when the door is first dogged, tighten the dog spindle nut until the dog just makes contact with the wedge.
- j. Un-dog, open the door, and repeat steps (h) and (i) until all dogs are completed.
- k. Establish a reference point by using a felt tip marker to place a match-mark on the self-locking nuts or jam nuts and spindles. Using the mark as a point of reference, tighten all self-locking dog spindle nuts (or bottom jam nuts) an additional 1+1/8 turns to achieve 1/8 inch of continuous gasket compression. If dogs are outfitted with jam nuts, tighten each of the second jam nuts against the first by using an adjustable wrench while firmly holding the first jam nut in position with an engineers wrench.
- l. After all adjustments are completed, un-dog and open the door. Using a rag, remove all chalk from the gasket, and perform a final chalk test. Apply chalk to the gasket contact surface of the knife-edge. Close and dog the door. Open the door and observe the chalk imprint of the knife-edge on the gasket. The chalk line should be continuous all around the entire gasket. If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again. If the chalk line on the gasket is still not continuous, back off the self-locking nut or jam nuts in the areas where the chalk imprint is missing, and repeat steps g. through j. as required for those dogs located in the area of non-contact.
- m. Repeat step (l) until a successful chalk test is achieved.
- n. Upon completion, remove chalk from knife-edge and gasket.

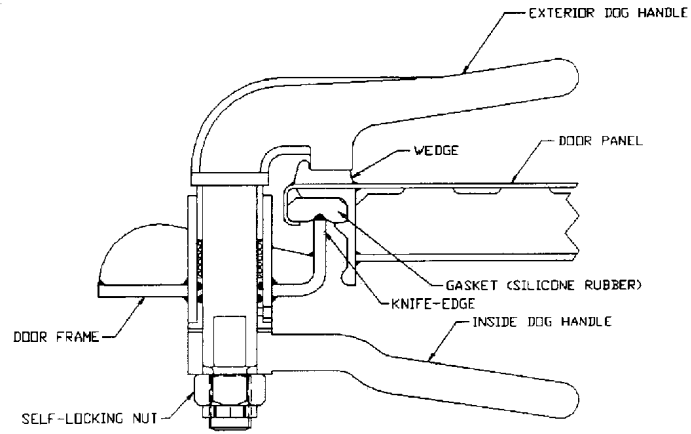


Figure 600-2.66.A. Dog With Self Locking Nut

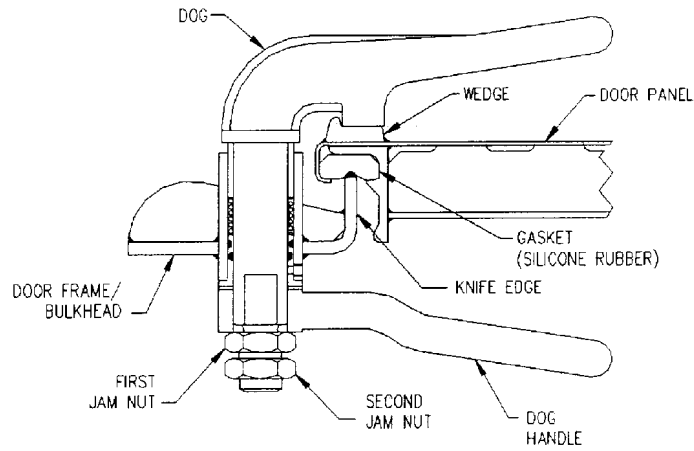


Figure 600-2.66.B. Dog With Jam Nuts

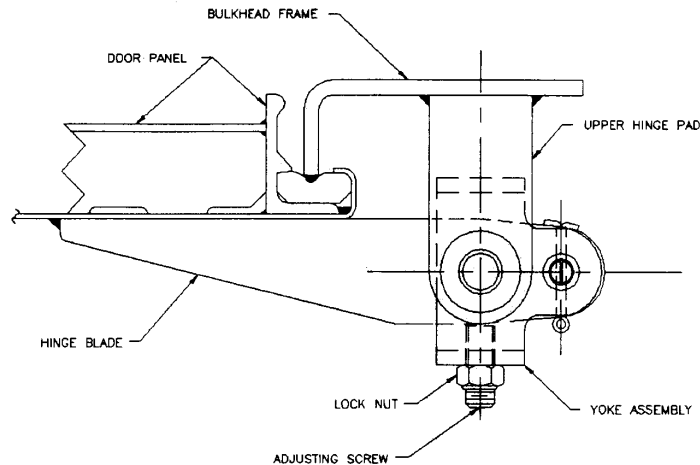


Figure 600-2.66.C. Paper Inserted

600-2.4.3.2.3 Individually Dogged Airtight Door, Bound-Hinge, 3-Dog, (with gasket installed) Adjustment Method 2. This procedure, when followed, will ensure proper adjustment of the dogs and hinges on an individually dogged airtight door to provide the required 1/8" gasket compression when in the fully dogged position.

#### NOTE

For safety purposes, secure the area on both sides of the door, or post a second person on the opposite side of the door to prevent personnel from passing through the access while performing this adjustment procedure. Read all steps in this procedure before beginning! Prior to performing any adjustment, ensure all bound hinge components are properly installed, free of wear, hinge yokes move freely, and there is no metal to metal contact between the knife-edge and gasket channel (see figure 600-2.66D) when the door is in the dogged position. If metal-to-metal contact is present, the quantity of hinge washers may need to be adjusted. If metal-to-metal contact cannot be corrected by adjusting the quantity of hinge washers, initiate action to repair (i.e. remove & relocate hinge pads) or replace door.

Tools and material required:

Wrench, adjustable, 14"

Wrench, engineers, open end, 1-5/16"

Wrench, Allen, 1/4" hex

Chalk

Rags

Paper, strip 3" x 11"

Marker, felt tip

Cloth, abrasive, 320 grit



## 600-2.4.3.2.3.1 Adjustment Procedure .

- a. Close and fully dog the door.
- b. Loosen all 3 self-locking dog spindle nuts (see figure 600-2.66D or jam nuts (see figure 600-2.66E) until all dogs and wedges are clearly separated.
- c. Loosen the 3 hinge adjusting screw lock nuts and adjusting screws until they are clearly separated and not applying any closing force to the hinges (see figure 600-2.66F).
- d. Un-dog and open the door.
- e. Using a rag, clean the knife-edge and gasket. If paint is present on knife-edge, remove using 320 grit abrasive cloth. Apply chalk to the gasket contact surface of the knife-edge.
- f. Close the door lightly but do not dog. Push firmly against the outside of the door panel at the center to obtain a chalk imprint on the gasket.
- g. Open the door and examine the gasket to determine where the chalk transferred from the knife-edge to the gasket. Gasket areas without chalk indicate the knife-edge and gasket did not make contact when the door was closed.

**NOTE**

The chalk line should be continuous all around the entire gasket. If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again.

- h. To aid in the hinge and dog adjustment sequence, mark with chalk on the outside of the door panel, the dog wedges and/or hinges in the areas where the gasket contacted the knife-edge. These are the areas where dog/hinge adjustment shall be accomplished first.

**NOTE**

A continuous transfer of chalk indicates the door panel and frame are very straight, and dog adjustment may begin. An imprint of less than 50% indicates the panel or frame is warped and action should be initiated to replace the closure.

**NOTE**

Perform steps (i) through (j) on the hinge side of door, beginning with hinges identified in step (h) closest to areas where gasket made contact with the knife-edge and finish with hinges that gasket did not contact the knife-edge.

**NOTE**

**DO NOT LEAN AGAINST THE PANEL DURING THE ADJUSTMENT PROCEDURE.**

- i. Insert a strip of paper between the gasket and knife-edge in the immediate area of the hinge. Close and dog the door (see figure 600-2.66G).
- j. Tighten the hinge-adjusting screw until the paper cannot be pulled out. If the paper is held tightly when the

door is first dogged, tighten the hinge screw until it just contacts the hinge blade. Ensure the lock nut is backed off sufficiently to allow free rotation of the adjusting screw.

- k. Un-dog and open the door, and repeat step (i) and (j) at the next marked hinge, identified in step (h), until all hinge-adjusting screws are completed. If there are no more marked hinges, adjust the remaining hinges. **DO NOT TIGHTEN LOCKNUT AT THIS TIME!**

**NOTE**

Perform steps (m) through (q) on the dog side of the door, beginning with the dogs identified in step (h) that are closest to areas where gasket made contact with the knife-edge and finish with dogs where the gasket did not contact the knife-edge.

**NOTE**

**DO NOT LEAN AGAINST THE PANEL DURING THE ADJUSTMENT PROCEDURE.**

- l. Insert a strip of paper between the gasket and knife-edge in the immediate area of the dog. Close and dog the door (see figure 600-2.66G).
- m. Tighten the self-locking dog spindle nut (or first jam nut) until the paper cannot be pulled out. If the paper is held tightly when the door is first dogged, tighten the dog spindle nut until the dog just makes contact with the wedge.
- n. Un-dog, open the door, and repeat steps (l) and (m) until all dogs are completed.
- o. With the door closed and dogged, accomplish steps (p) through (t).
- p. For the hinge adjusting screws, establish a reference point by using a felt tip marker to place a match-mark on the yoke and adjusting screw threads. Using the match-mark as a point of reference, tighten all hinge-adjusting screws an additional  $1+5/8$  turns to achieve  $1/8$  inch of continuous gasket compression. Tighten the jam nuts to lock the hinge adjusting screws in place while holding the hinge adjusting screw firmly in position with an Allen wrench.
- q. For the dogs, establish a reference point by using a felt tip marker to place a match-mark on the self-locking nuts or jamb nuts and spindles. Using the mark as a point of reference, tighten all self-locking dog spindle nuts (or bottom jam nuts) an additional  $1+1/8$  turns to achieve  $1/8$  inch of continuous gasket compression. If dogs are outfitted with jam nuts, tighten each of the second jam nuts against the first by using an adjustable wrench while firmly holding the first jam nut in position with an engineers wrench.
- r. After all adjustments are completed, un-dog and open the door. Using a rag, remove all chalk from the gasket, and perform a final chalk test. Apply chalk to the gasket contact surface of the knife-edge. Close and dog the door. Open the door and observe the chalk imprint of the knife-edge on the gasket. The chalk line should be continuous all around the entire gasket. If the chalk line is not continuous, ensure an adequate amount of chalk is present on the knife-edge in the area of non-contact. If chalk is not visible on the knife-edge, apply chalk, dog and un-dog the door again. If the chalk line on the gasket is still not continuous, back off the hinge adjusting screws and/or self-locking nut/ jam nuts in the areas where the chalk imprint is missing, and repeat adjustment steps (l) through (k) as required for those dogs/hinges located in the area of non-contact.
- s. Repeat step (q) until a successful chalk test is achieved.
- t. Upon completion, remove chalk from knife-edge and gasket.

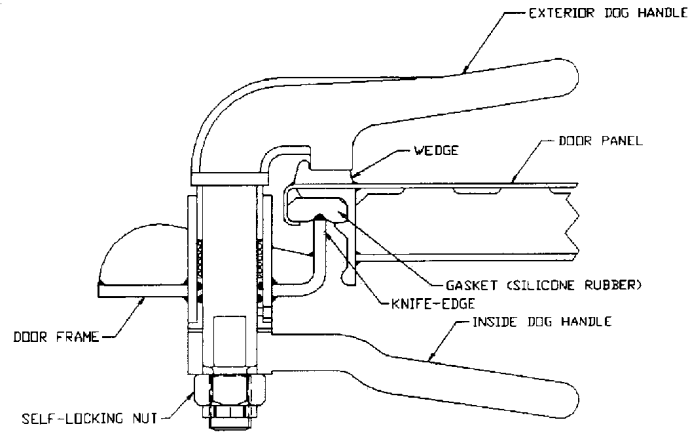


Figure 600-2.66.D. Dog With Self-locking Nut

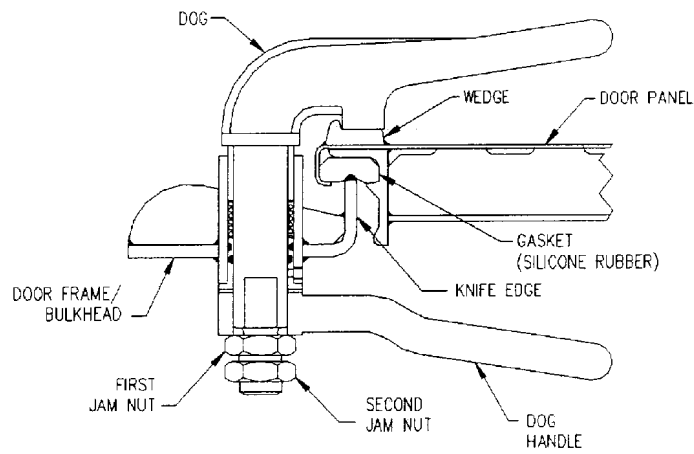


Figure 600-2.66.E. Dog With Jam Nuts

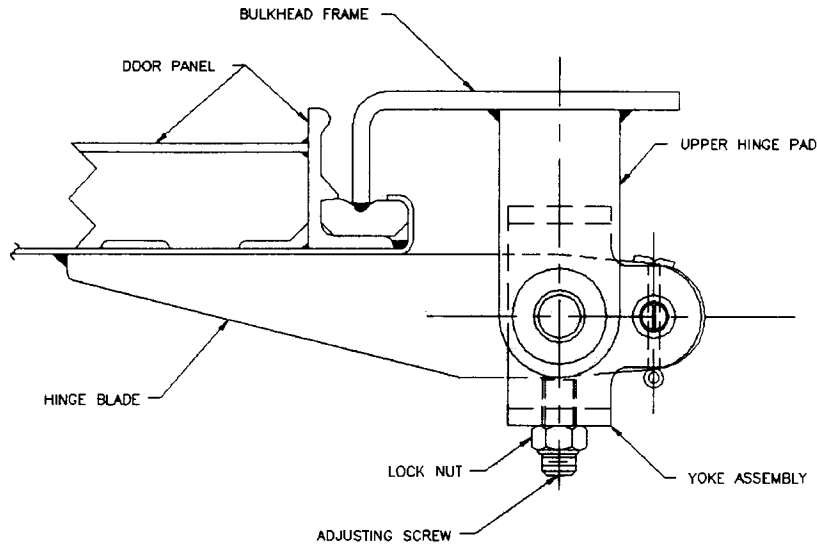


Figure 600-2.66.F. Bound Hinge Arrangement

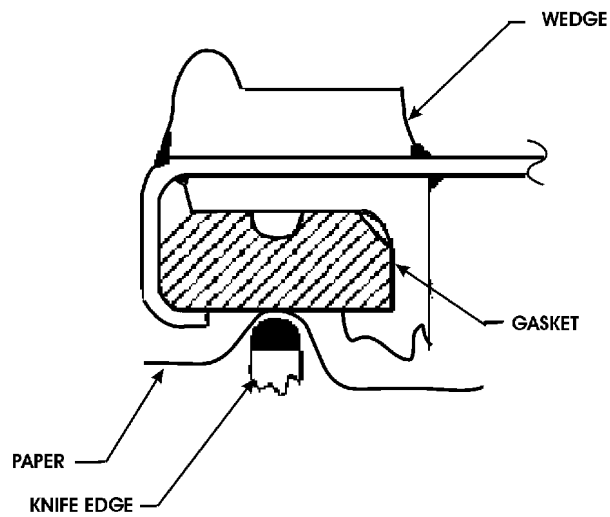


Figure 600-2.66.G. Paper Inserted (Wedge side shown, hinge side similar)

#### 600-2.4.3.2.4 Other Door Maintenance.

- a. After adjusting the dogs and/or hinges, accomplish a chalk test inspection. (Refer to paragraph [600-2.3.2.5](#).) 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.

## 600-2.4.3.3 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 paragraph [600-2.3.2.7](#) 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.

**600-2.4.3.3.1 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 [600-2.67](#).) 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.

**NOTE**

Closures equipped with self-lubricated bushings do not need stick packing or string packing. Refer to paragraph [600-2.4.2.3.2](#) 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.

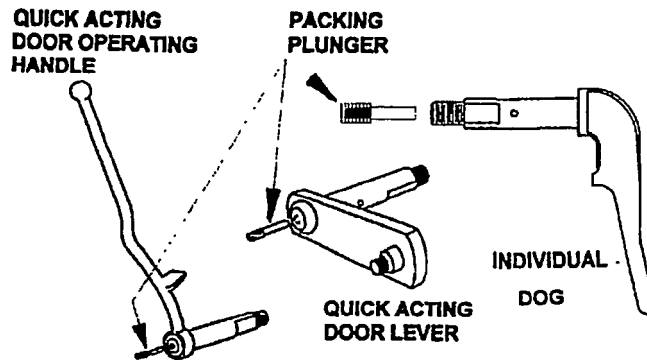


Figure 600-2.67. Packing Plunger Locations

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.

600-2.4.3.3.2 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. 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 paragraph [600-2.4.2.5.1](#) for installation instructions for these bushings.

600-2.4.3.3.3 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. 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.

### 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.

600-2.4.3.4 Spindle Sleeve Preparation and Bushing Installation. Clean and prepare all spindle sleeves of a watertight closure before installing bushings. For ordering replacement bushings, note that spindle bushings and springs for quick-acting doors are 1-inch in diameter. Spindle bushings and springs on individually dogged doors are 1-1/8 inch in diameter. On some older ships, individually dogged doors have 1-inch diameter spindle bushings, and both the inner and outer bushings are flanged. These older bushings, though obsolete, are still available through watertight door part companies, but are not available through the Navy Supply System. For installation of self-lubricated bushings, refer to paragraph 600-2.4.2.5.1 or paragraph 600-2.4.2.5.2. To prepare spindle sleeves and install bushings, accomplish the following:

### WARNING

**Exercise caution when using flammable solvent.**

- a. For steel doors, scrape rust, paint, and old grease from the spindle sleeves using a flat tipped punch and a 1-inch diameter rotary wire brush chucked in an electric drill. A no. 320 grit aluminum oxide cloth can also be used. Remove all rust and corrosion; otherwise, the straight bushing in a dog assembly will not be free to move in the spindle sleeve under spring tension. For all doors, remove all traces of packing with a rag and dry cleaning solvent.
- b. Clean out the setscrew hole in each spindle sleeve with a 12-28UNF tap. Thinly coat the inside of each spindle sleeve with a silicone compound.
- c. Scribe a line on the face of each flanged bushing to indicate the location of the setscrew hole (except for flanged bushings of quick-acting handles). This will make it much easier later to align the hole in the bushing with the setscrew hole in the door sleeve. Thinly coat flanged bushings with a silicone compound, and insert one bushing into each spindle sleeve from the linkage side of the door. Align the hole in each bushing with the setscrew hole in the door sleeve.
- d. Coat the setscrews with antiseize compound. Insert each setscrew into a setscrew hole, and lock the bushing to the sleeve (except for flanged bushings for quick-acting handles). If the setscrew hole is worn out and will not hold a 12-28UNF dog point setscrew, complete the repair in one of the following two ways:



1. Drill and tap an oversize hole in the sleeve with a no. 7 drill and 1/4-20UNC tap. (Setscrews of this size are available commercially.)
2. Remove the flanged bushing, and drill and tap a completely new hole somewhere else on the sleeve. Use a no. 14 drill and 12-28UNF tap. Install and rotate the bushing to line up with the new hole.

600-2.4.3.5 Self-Lubricated Bushing Installation. **(MACHALT 444)** Oilite phosphor bronze bushings on dog assemblies of steel doors can be replaced with self-lubricated stainless steel bushings that are Teflon coated and have an O-ring mounting. These bushings were recently authorized for new construction; for 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, or authorized machinery alteration (MACHALT). 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. Accomplish the following installation procedure to replace dog assembly bushings with a self-lubricated bushing replacement parts kit.

- a. Remove the existing dog assembly and dog point setscrew. (Refer to paragraph 600-2.4.3.6.) If unable to remove the existing setscrew, drill and tap at the location for the 1/4-20UNC dog point setscrew furnished in the repair parts kit.

**WARNING**

**Exercise caution when using flammable solvent.**

- b. Remove all traces of packing residue from the dog sleeve with a rag and dry cleaning solvent.
- c. Remove corrosion from the interior of the sleeve and ends of sleeve with no. 320 grit aluminum oxide cloth (for steel sleeves). Clean with a rag and solvent.
- d. Clean the spindle of the dog assembly lever or individual dog with a rag and solvent.
- e. Use a soft-faced hammer to install the plastic plug in the transverse hole in the spindle. Do not remove the packing plunger.

**CAUTION**

**Use extreme care when driving the plug with a soft-faced hammer. Lay the spindle on wood or other soft material. Avoid metal-to-metal contact. It may be necessary to use a 1/4-inch or slightly smaller diameter drift punch to drive the plug. Avoid striking the spindle.**

**CAUTION**

**Do not force the bushing or attempt to drive it with a mallet or hammer. The self-lubricated bushing has a Teflon ring that can be easily damaged.**

- f. Apply a thin coat of silicone compound to the interior of the new flanged bushing. Trial fit the bushing to the spindle. The bushing should slide onto the spindle with normal hand pressure.

**CAUTION**

**Do not force the bushing or attempt to drive it with a mallet or hammer.**

- g. Apply a thin coat of silicone compound to the exterior of the flanged bushing. Trial fit the bushing to the dog sleeve. Applying hand pressure, carefully work the flanged bushing into the sleeve.



- h. Apply a thin coat of silicone compound to the inner surface of the dog sleeve on the exterior side (panel side) of the door. Trial fit the straight bushing to the sleeve.
- i. Use the black mark on the edge of the flanged bushing to assist in aligning the hole in the bushing. (It may be necessary to remove the tape that joins the thrust washer to the bushing in order to locate the black mark.) Temporarily tape the washer to the plug. To assist in aligning the bushing mark to the setscrew hole in the sleeve, mark the position of the hole on the outer circumference of the sleeve.

**NOTE**

Align the bushing mark with the sleeve hole carefully. Since the adhesive/sealant sets up quickly, the hole in the flanged bushing must be in exact alignment with the hole in the dog sleeve.

- j. Apply a thin coat of adhesive/sealant to the outer edge of the dog sleeve. Immediately work the O-ring into the dog sleeve, and press the flanged bushing to a snug fit with the sleeve.

**WARNING**

**The adhesive/sealant is hazardous material.**

**CAUTION**

**Do not tighten the setscrew.**

- k. Install the CRES dog point setscrew, and rotate the set key one turn.
- l. Apply a thin coat of silicone compound to the lever or dog spindle and to the exterior of the straight bushing. Carefully insert the spindle into the sleeve. Remove the tape holding the thrust washer and the flanged bushing together.
- m. Install the remainder of the dog assembly, except for the second jamnut (if not using self-locking nuts), according to normal procedures. (Refer to paragraph [600-2.4.2.7](#) for quick-acting dog installation or paragraph [600-2.4.3.6](#) for individual dog installation.)
- n. Apply antiseize compound to the setscrew. Tighten the setscrew to near flush with the surface of the dog sleeve, or until full tightness is achieved. At this point, back off the set key one-half turn.
- o. Repeat step [a](#) through step [n](#) for each dog assembly.
- p. When all dog assemblies are completed, adjust the dogs and accomplish a chalk test. Refer to paragraph [600-2.4.2.1](#) for watertight door dog adjustments and to paragraph [600-2.3.2.5](#) for procedures on accomplishing a chalk test.
- q. After adjustments and a chalk test are completed, install the second jamnut (if not using self-locking nuts). Hold the nut that is already installed with a 1-5/16-inch flat engineer's wrench. Thread the second nut onto the spindle, and tighten it against the first nut with another 1-5/16-inch wrench.

**600-2.4.3.6 Individual Dog Repair.** This section describes procedures for disassembling and repairing an individual dog mechanism. A complete disassembly is necessary if inspection of the dog reveals that the dog does not operate smoothly or that the bushings or compression spring require replacement.

**600-2.4.3.6.1 Individual Dog Disassembly and Repair.**

- a. Remove the self-locking hex nut (or two jamnuts) and the dog handle from the inside of the door. Remove the dog and paint shield from the outside of the door. See figure [600-2.68](#) and figure [600-2.69](#).

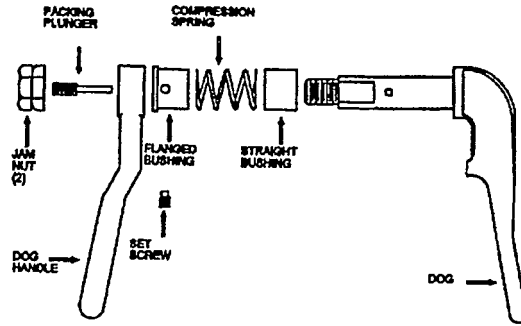


Figure 600-2.68. Individual Dog Assembly

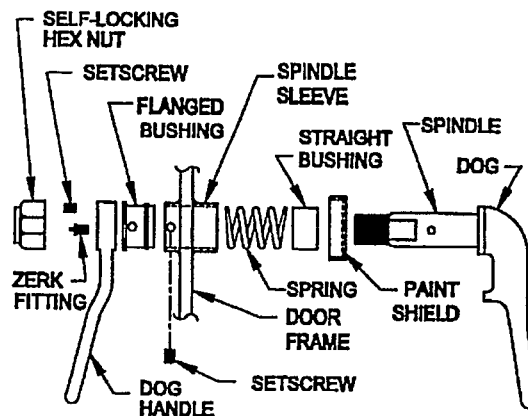


Figure 600-2.69. Individual Dog Assembly Modified by MACHALT 167-31010 (ECP-526)

- b. Remove the straight bushing and compression spring from the spindle sleeve.
- c. Use an Allen wrench to loosen the setscrew on the flanged bushing. Remove the flanged bushing from the spindle sleeve.

**WARNING**

**Use caution when working with flammable solvent.**

- d. For steel doors, scrape rust, paint, and old grease from the spindle sleeve using a flat tipped punch and a 1-inch diameter rotary wire brush chucked in an electric drill. A no. 320 grit aluminum oxide cloth can also be used. Remove all rust and corrosion; otherwise, the straight bushing in a dog assembly will not be free to move in the spindle sleeve under spring tension. Remove all traces of packing with a rag and dry cleaning solvent.
- e. Clean out the setscrew hole in the spindle sleeve with a 12-28UNF tap, if necessary. Coat the inside of the spindle sleeve with a thin coat of silicone compound.
- f. Inspect all wear parts for excessive wear, and obtain replacement parts as required. Refer to paragraph [600-2.4.2.5](#) for additional information.
- g. Clean the dog shaft with solvent to remove all traces of grease. Use a no. 320 grit aluminum oxide cloth to remove burrs from the dog shaft.

**NOTE**

Step h is not required where self-lubricated bushings are installed.

- h. Remove the packing plunger from the dog shaft. Discard the packing plunger if it has a damaged screwdriver slot or threads. If the internal thread on the spindle is damaged, it can be retapped with a 5/16-24UNF tap. Remove the chips from the hole with a scribe and cotton swab. Replace the packing plunger.

## 600-2.4.3.6.2 Individual Dog Installation.

**NOTE**

For repair/installation of individual dogs having MACHALT 167-31010 (ECP-526) installed, proceed to paragraph 600-2.4.3.6.2.1. MACHALT 167-31010 (ECP-526) is applicable to exterior and well deck doors, and to other doors in high moisture/humidity areas that have carbon steel spindle sleeves. MACHALT 167-31010 (ECP-526) is not applicable to interior doors or doors with CRES spindle sleeves. MACHALT 167-31010 (ECP-526) has been installed if a CRES paint shield is installed on the exterior end of the spindle sleeve.

- a. When installing new self-lubricated bushings with a replacement parts kit, install the plastic plug that comes in the kit into the hole in the dog shaft. Do not remove the packing plunger.
- b. Scribe a line on the face of the flanged bushing to indicate the location of the setscrew hole. This will make it easier later to align the hole in the bushing with the setscrew hole in the door sleeve. Coat the flanged bushing with a thin coat of silicone compound, and insert the bushing into the spindle sleeve from the linkage side of the door. Align the hole in the bushing with the setscrew hole in the door sleeve.
- c. Coat the setscrew with antiseize compound. Insert the setscrew into the setscrew hole, and lock the bushing to the sleeve.
- d. Coat the dog shaft with silicone compound, and insert the shaft into the spindle sleeve.
- e. Insert a compression spring (new or cleaned) onto the dog spindle from the front side of the door. With Oilite bronze bushings, use only phosphor bronze springs. With stainless steel bushings, use only stainless steel springs. Wrap a 6-inch length of string packing between the spring coils over the spindle.

**NOTE**

Watertight doors that have self-lubricated bushings do not require string packing or stick packing.

- f. Coat the straight bushing with silicone compound, and install the bushing onto the spindle from the front side of the door. The bushing should slide freely back and forth under spring tension in the spindle sleeve.
- g. Install the dog handle, and attach one jamnut or self-locking nut. Tighten the nut just enough to engage three threads.
- h. If using jamnuts, do not install the second jamnut at this time. Install the second jamnut only after all assembly/adjustments and a chalk test are completed. Refer to paragraph 600-2.4.3.2.2 for watertight door dog adjustments and to paragraph 600-2.3.2.5 for procedures on accomplishing a chalk test.

600-2.4.3.6.2.1 Individual Dog Installation (MACHALT 526)- Sintered Bronze Bushings With Elisha Technologies EDC 1270 EPL Grease and Cres Paint Shield (See Figure 600-2.69).

**NOTE**

On exterior or well deck doors equipped with steel sleeves, MACHALT 167-31010 (ECP-526) removes existing Oilite bronze bushings, string and stick pack-

ing, 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.

- a. Clean internal grease passages of spindle using EDC cleaning fluid and cotton tip applicators. Clean internal threads of spindle for packing plunger with a 5/16-24UNF tap, using LPS Tapmatic no. 1 gold as a lubricant. Remove any metal particles from grease passage. Install zerk fitting.

**CAUTION**

**When trial fitting or installing the new flanged bushing, do not force or attempt to drive it onto the spindle or into the spindle sleeve with a mallet or hammer, as flanged bushing O-rings can easily be damaged. The flanged bushing should slide on with normal hand pressure.**

**CAUTION**

**Do not allow the threads of the spindle shaft to come in contact with the interior of the flanged bushing or the spindle sleeve.**

- b. Trial fit flanged bushing by applying a thin coat of EDC 1270 EPL grease to the interior of flanged bushing and slide them onto the spindle with normal hand pressure. Then, remove flanged bushing.
- c. Trial fit flanged bushing by applying a thin coat of EDC 1270 EPL grease to the exterior of flanged bushing and sliding into the spindle sleeve with normal hand pressure. Then, remove flanged bushing.
- d. Trial fit straight bushing by applying a thin coat of EDC 1270 EPL grease to the inner surface of spindle sleeve on the outside (panel side) of the door and sliding the straight bushing into the spindle sleeve with normal hand pressure. Then, remove straight bushing.
- e. Align the flanged bushing with the setscrew hole on the spindle sleeve. Work flanged bushing into the spindle sleeve until the flanged bushing is pressed snugly against the spindle sleeve.
- f. Install the setscrew, one turn only, into the hole of spindle sleeve.
- g. Apply EDC 2400 caulk to the setscrew installed in step (f). Tighten the setscrew to near flush with the inside surface of the spindle sleeve bushing.
- h. Install compression spring onto spindle shaft.

**CAUTION**

**Do not allow the threads of the dog and spindle shaft to come in contact with the interior of the flanged bushing or spindle sleeve or straight bushing.**

- i. Install paint shield onto dog and spindle. Apply a thin coat of EDC 1270 EPL grease to the dog and spindle. Apply a thin coat of EDC 1270 EPL grease to the exterior of straight bushing and install onto spindle shaft. Then, carefully install dog and spindle, paint shield, and straight bushing into the spindle sleeve.
- j. Install dog handle and self-locking hex nut onto spindle. Tighten the self-locking hex nut just enough to remove play.
- k. Repeat step **a** through step **j** for remaining dog assemblies.
- l. Adjust dogs and chalk test in accordance with paragraph [600-2.4.3.2.2](#).
- m. After adjustments and a chalk test are completed, lubricate dog spindle sleeve in accordance with paragraph [600-2.4.3.3](#).

600-2.4.3.7 Individually Dogged Watertight and Airtight Door Hinge Repair. Due to more frequent use, quick-acting watertight doors are more likely to experience wear to hinge assemblies than individually dogged doors. Refer to paragraph 600-2.3.3 for conditions that require repair or replacement of hinge pins and hinge assemblies. Repairs to a watertight door hinge assembly can be accomplished without disassembling any of the closure mechanism. Review the safety procedures described in paragraph 600-2.1.2 before starting repair work to door hinges.

600-2.4.3.7.1 Disassembly and Repair of Hinge Assemblies (on Doors Without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed). To disassemble and repair hinge assemblies, accomplish the following:

- a. With a hammer and chisel, knock the hinge pin collars off the bottom of the hinge pins. See figure 600-2.70.

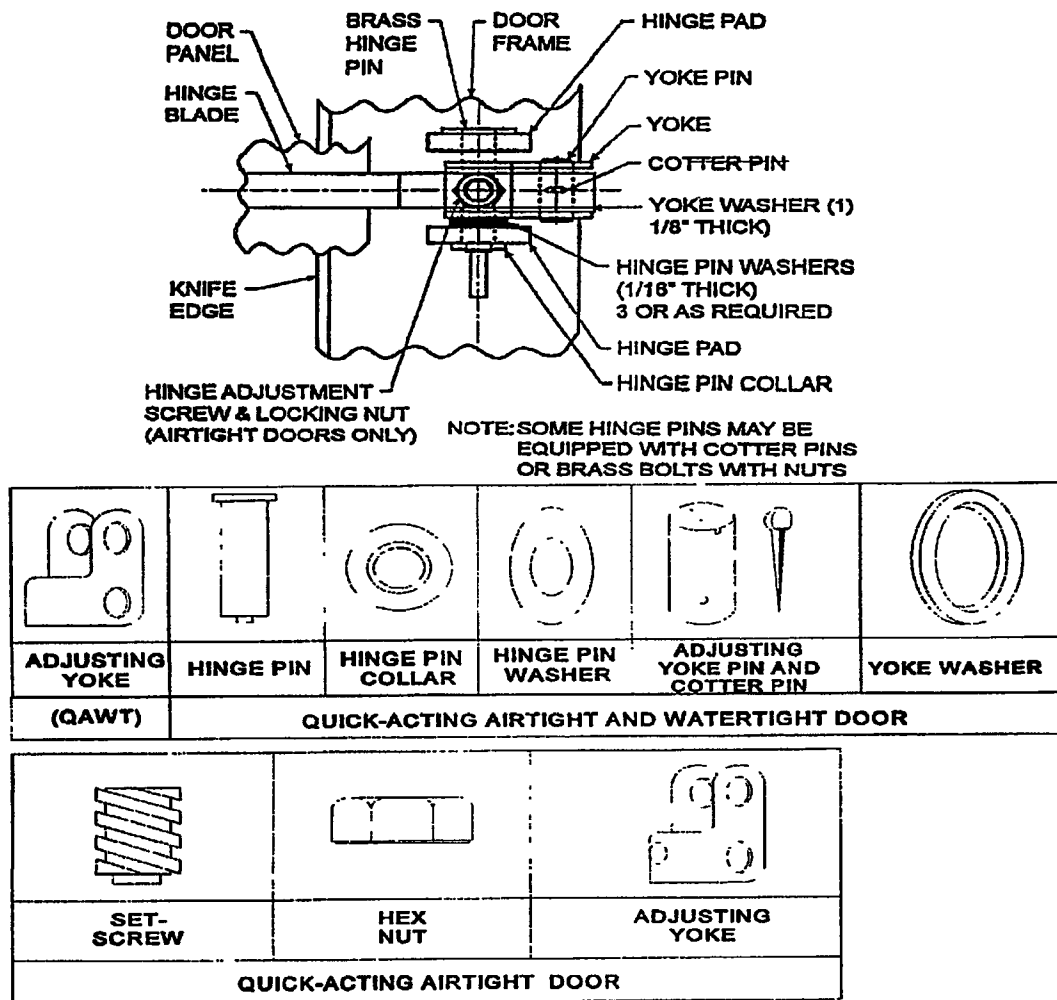


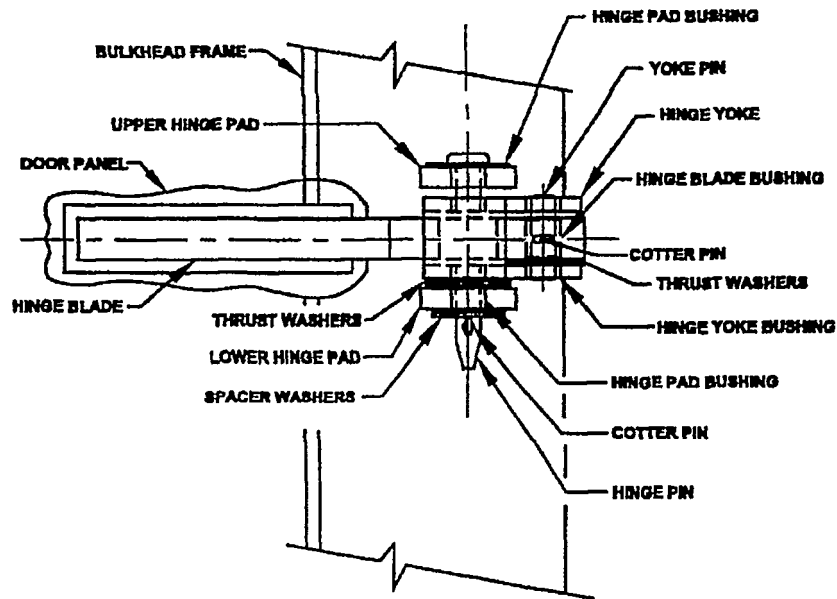
Figure 600-2.70. Watertight Door Hinge Components (For Doors Without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed)

- b. Use a flat tipped drift punch to drive out the hinge pins. If the hinge pins are badly worn, have another person pick up the door from the bottom and rock it back and forth while the pins are driven out. The rocking action tends to pull the grooves that are worn into the shank away from the other steel hinge parts, allowing easier removal. Set the door panel aside, with the hinge side up.

- c. Disassemble the adjusting pin and yoke of each hinge assembly. On quick-acting airtight doors, the adjusting yoke has a setscrew and hex nut fitted to the front side. This yoke is used to push the hinge side of the door and gasket up against the knife-edge, since there are no dogs on the hinge side of the airtight door for this purpose.
- d. Examine the hinge parts for excessive wear, and clean the parts or procure replacement parts as required. Brass hinge pins are recommended over stainless steel, and if stainless steel hinge pins are found they should be replaced with brass.
- e. Reassemble the adjusting yokes and pins onto the door hinge blades. Be sure to insert a 1/8-inch thick brass flat washer on top of the bottom adjusting yoke blade before inserting the adjusting pin and cotter pin.
- f. Set the door in the frame.
- g. Place three 1/16-inch thick brass flat washers between the top of the hinge blade and the lower adjusting yoke leaf. Insert the hinge pins.
- h. Close and dog the door. Ensure the knife-edge sits in the center three-fifths of the width of the door gasket at the top and bottom. There should be no contact between the metal on the door gasket channel and the knife-edge. If there is metal-to-metal contact, shim the door up or down by adding or removing one 1/16-inch washer from each hinge. See figure [600-2.70](#).
- i. To lock the hinge pin to the collar, have someone hold a sledge hammer over the top of each hinge pin while the collar is inserted, bevel side down, over the boss on the bottom of the hinge pin. Peen over the boss with the rounded end of a ball peen hammer to lock the collar to the hinge pin. The weight of the sledge hammer resting on top of the hinge pin keeps the pin from backing out as the boss is peened over.

600-2.4.3.7.2 Disassembly and Repair of Hinge Assemblies (on Doors With MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed).

- a. Remove cotter pins, spacer washers, hinge pins, and thrust washers. See figure [600-2.73](#). Set the door panel aside with the hinge side up.
- b. Remove cotter pins, yoke pins, hinge yoke, thrust washers, and hinge pin spacer from each hinge assembly.
- c. Clean the hinge parts and examine for excessive wear. Procure replacement parts as required.
- d. Apply a thin film of quick forming adhesive to the outside diameter surface of the hinge pad bushings, ensuring no adhesive comes in contact with the inside diameter.



<b>HINGE PIN &amp; COTTER PIN</b>	<b>YOKE PIN &amp; COTTER PIN</b>	<b>HINGE YOKE</b>	<b>HINGE PAD BUSHING</b>
<b>HINGE BLADE BUSHING</b>	<b>HINGE YOKE BUSHING</b>	<b>SPACER BUSHING</b>	<b>THRUST WASHER</b>
<b>QUICK-ACTING AIRTIGHT AND WATERTIGHT DOORS</b>			

Figure 600-2.71. Watertight Door Hinge Components (For Doors With MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed)

- e. Install hinge pad bushings into the upper and lower hinge pads and, if necessary, gently tap into upper and lower hinge pads.
- f. Temporarily install hinge pins while adhesive is forming in order to align hinge pad bushings. Remove hinge pins after adhesive is formed.
- g. Insert yoke pin spacer into the yoke pin hole in the hinge blade. Align cotter pin holes of the yoke pin spacer with the cotter pin holes of the hinge blades. Position hinge yoke assembly on hinge blade, and partially insert yoke pin with slotted end up.
- h. Install two thrust washers between the bottom of hinge blades and the hinge yoke assemblies. Align thrust washers and fully insert yoke pins. Align cotter pin holes in hinge blades, hinge yoke assemblies, and yoke pins, and install cotter pins. Ensure hinge yoke assemblies rotate freely around the yoke pins.
- i. Position door upright and resting on deck close to hinge pads. Partially rotate hinge yokes away from hinge pin holes in hinge blades. Insert hinge pin spacers in holes of hinge blades. Then, rotate hinge yoke assemblies back into position over the hinge pin holes in the hinge blades, ensuring hinge pin spacers remain in place and upright.
- j. Lift door into position on the hinge pads, and insert hinge pins through the hinge pads, hinge yokes, and spacer



bushings. With one person supporting the door on the handle side, pry upward on the underside of the hinge blades and lower hinge pads with a long flat tipped screwdriver. Lift the hinge pins enough to insert two thrust washers between the hinge yokes and the lower hinge pad bushings. Center thrust washers, and fully insert hinge pins.

- k. Install spacer washers and cotter pins into hinge pins.
- l. Close and dog the door. Ensure the knife-edge sits in the center three-fifths of the width of the door gasket at the top and bottom. There should be no contact between the metal on the door gasket channel and the knife-edge. If there is metal-to-metal contact, shim the door up or down by adding or removing one 1/16-inch thrust washer from each hinge. See figure 600-2.71.

600-2.4.3.8 Dog Wedge Replacement. A dog wedge must be replaced if it is worn more than halfway down, or if it has deep grooves carved into it or other signs of excessive wear or damage. The wedge may be either welded, riveted, or bolted in place with machine screws. See figure 600-2.72 and accomplish the procedure in paragraph 600-2.4.3.8.1, paragraph 600-2.4.2.8.2, or paragraph 600-2.4.2.8.3, as applicable.

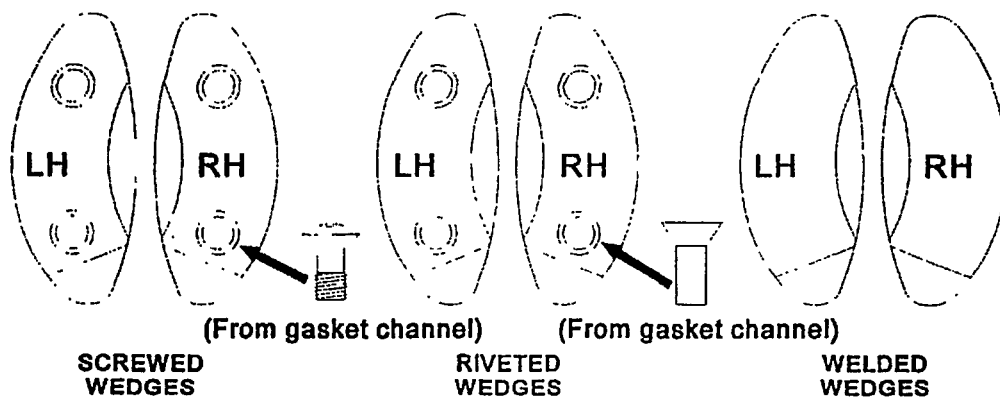


Figure 600-2.72. Dog Wedges

#### 600-2.4.3.8.1 Replacement of Welded Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.
- b. Remove the damaged wedge with a portable grinder.
- c. Position the new wedge exactly over the position of the old wedge.
- d. Weld the new wedge in place using the GTAW (tungsten inert gas (TIG)) or shielded metal arc welding (SMAW, metal inert gas (MIG)) welding process. Welding electrodes must conform to MIL-E-278, aluminum bronze, MIL-E-CU/AL-A, for SMAW welding or MIL-E-23765/3, aluminum bronze, CUAL-A2, for GTAW (TIG) welding.
- e. Reinstall the door, washers, hinge pins, and gasket.
- f. Adjust the door as required. Refer to paragraph 600-2.4.3.2 for procedures on making adjustments.

#### 600-2.4.3.8.2 Replacement of Riveted Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.
- b. Remove the damaged wedge by drilling out the center of the rivet using a hammer and center punch.
- c. Use a nylon scrubbing pad to clean the area under the wedge.
- d. Use Formula 150 primer on the area under the wedge.



- e. Install dielectric barrier on the area under the wedge.
- f. Position the new wedge exactly over the position of the old wedge. Rivet the wedge into place.
- g. Reinstall the door, washers, hinge pins, and gasket.
- h. Adjust the door as required. Refer to paragraph [600-2.4.3.2](#) for procedures on making adjustments.

#### 600-2.4.3.8.3 Replacement of Machine Screwed Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.
- b. Remove the damaged wedge by removing the 5/16-24UNC machine screws.
- c. Use a nylon scrubbing pad to clean the area under the wedge.
- d. Use Formula 150 primer on the area under the wedge.
- e. Install a dielectric barrier on the area under the wedge.
- f. Position the new wedge exactly over the position of the old wedge. Use 5/16-24UNC machine screws to bolt the wedge into place.
- g. Reinstall the door, washers, hinge pins, and gasket.
- h. Adjust the door as required. Refer to paragraph [600-2.4.3.2](#) for procedures on making adjustments.

**600-2.4.3.9 Dog Handle Spring Clips.** Individually dogged doors have a spring clip assembly for each dogging handle. Over time, the spring clip may snap off due to metal fatigue. To replace a spring clip assembly, accomplish the following:

- a. Remove the two screws holding the clip to the tab that is welded to the door frame. Use an offset screwdriver to gain access to the screw heads. If the screws are frozen and impossible to remove, chisel the screw heads off flush with the surface. Redrill the holes with a no. 21 drill, and tap the holes with a 10-32UNF tap.
- b. Spring clip assemblies come in two different styles. See figure [600-2.73](#). The center-to-center distance between screw holes on newer doors is 1/2-inch. On older doors, the distance between screw holes is 11/16-inch. If the holes on the new spring clip do not match the holes on the door, it will be necessary to drill a new hole in the mounting tab welded to the door. Mark the new hole location with a small center punch. Drill the new hole with a no. 21 drill, and tap with a 10-32UNF tap. Screw on the new spring clip.

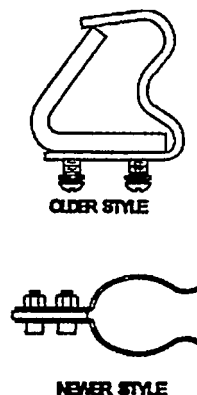


Figure 600-2.73. Spring Clip Assemblies

## 600-2.5 Watertight Door Installation.

Steel and aluminum watertight door installation and replacements will be detailed.

600-2.5.1 Steel Watertight Door and Frame Installation. This section describes procedures for cutting an opening in a bulkhead to install a steel watertight door, and for installing the door frame and door. Instructions for replacing an existing flange type watertight door frame with a new flange and frame are provided in paragraph 600-2.5.2.

#### 600-2.5.1.1 Preparation of the Bulkhead.

- a. Inspect the bulkhead for straightness. If the bulkhead is warped or twisted, straighten with a strongback. Use an angle or flat bar. If the bulkhead is bowed, make a cut in the plate. Use a strongback to flatten the bowed area, and reweld the cut. See figure 600-2.74.

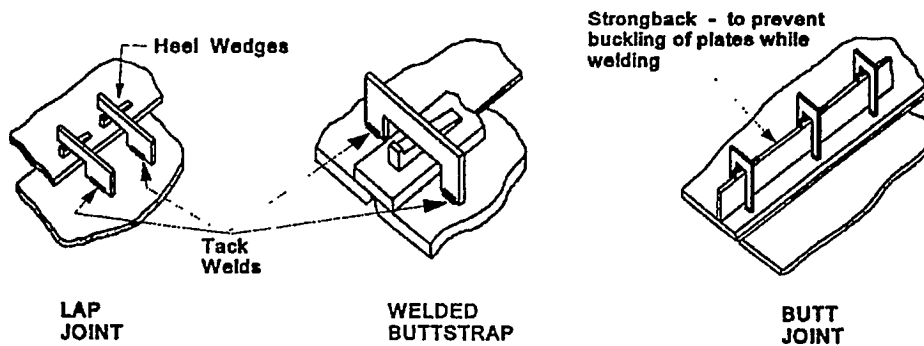


Figure 600-2.74. Methods of Securing Welded Structure

- b. If the bulkhead has no header or longitudinal T-bar at approximately 6 feet above the deck, install a new one. Locate the header 6 inches above the upper edge of the location for the clear opening of the watertight closure. Weld the entire length of the header. See BUSHIPS Drawing 805-1362325, Revision C, Reinforcement for Watertight and Airtight Door Openings.
- c. If the vertical stiffeners in the bulkhead are more than 12 inches from the location for the door frame, install chocks around the frame, one chock above and one below the intended location for each dog. Chocks must be constructed of the same material as the door frame. See BUSHIPS Drawing 805-1362325, Revision C.
- d. The area of the bulkhead that contacts the closure frame must be smooth. No welds or tacks are permitted in the lap area. For a steel bulkhead, grind the surface to remove all roughness.
- e. Prior to installing the door in the bulkhead, rework the door for fitness to be installed. Ensure all parts are operable and have no defects. Refer to paragraph 600-2.3 for door inspection procedures.
- f. Remove the door from the door frame.
- g. To mark the cutting line, have another person hold the door frame against the bulkhead in the exact location where the clear opening is to be cut. Lay out the vertical and horizontal centers of the clear opening on the bulkhead. Mark the cutting line for the clear opening. For a steel door, center punch the line every 1/2 inch. Remove the door frame from the bulkhead.
- h. Using an exothermic torch or plasma cutter, cut the opening for the door in the bulkhead and remove the cut panel.

#### 600-2.5.1.2 Installation of the Steel Watertight Door Frame.

600-2.5.1.2.1 Steel-to-Steel Installation. The fit-up of the door frame to the bulkhead is to be metal-to-metal. The fit-up should be uniformly tight, with no space between the frame and the bulkhead.

- a. Align the door frame over the clear opening, and use C-clamps to hold the frame in place. If this is a one person operation, tack weld two 2- x 2- x 1/4-inch thick plates approximately 12 inches apart to use as a ledge for the frame while clamping in place.
- b. Tack weld (skip weld) the door frame to the bulkhead every 6 inches on both sides. Keep the heat even so as not to draw and warp the assembly. Tacks on opposing sides of the fit-up should be staggered. Tacks should be approximately 1-inch in length.
- c. Fill in between the tack welds, working from one end to the other and staggering welds to prevent warping. Move from one side of the installation to the other often to keep the heat even.
- d. After the structure has been completely welded, chip away all slag.

#### 600-2.5.1.2.2 Steel-to-Aluminum Installation.

- a. Align the door frame over the clear opening, and use C-clamps to hold the frame in place. If this is a one person operation, tack weld two 2- x 2- x 1/4-inch thick plates approximately 12 inches apart to use as a ledge for the frame while clamping in place.
- b. Drill holes for huck rivets through the frame and bulkhead. For a standard 8- or 10-dog door, drill approximately 60 holes. Drill the holes close enough to the outer edge of the door frame to avoid having huck rivets interfere with the operation of the quick-acting linkage assembly. See figure 600-2.75.
- c. Before installing the door frame, apply two layers (8-1/2 millimeters each, 17 millimeters total) of dielectric barrier tape to the area of the bulkhead that will be in contact with the door frame. The bulkhead must be smooth. (Refer to paragraph 600-2.5.1.1) Install strips of dielectric tape along the entire edge of the clear opening. Cut curved pieces for the corners. See figure 600-2.75.

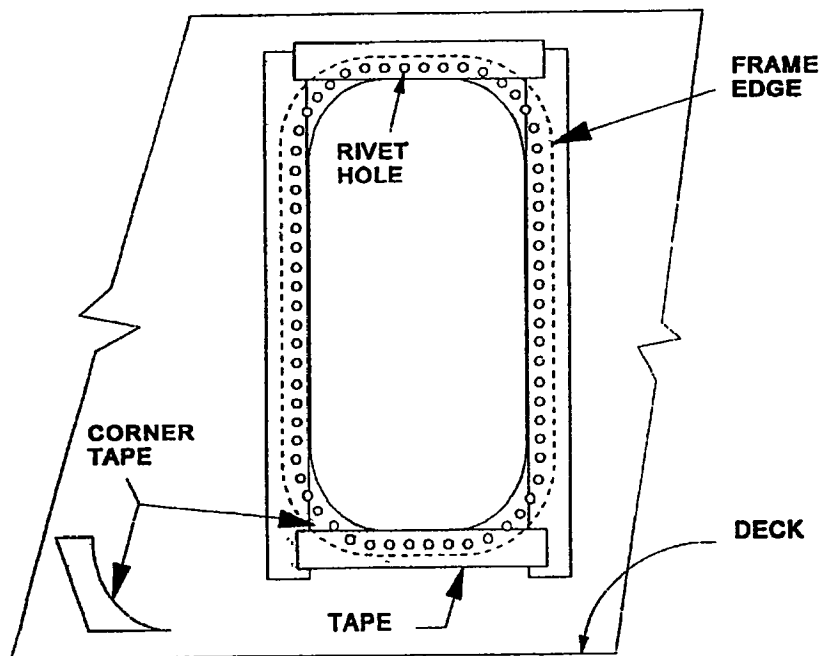


Figure 600-2.75. Dielectric Tape Installation

- d. Use C-clamps to temporarily secure the door frame to the rim of the clear opening. Install hex head bolts and nuts in enough of the rivet holes to secure the frame. Remove the C-clamps.
- e. Huck rivet the frame to the bulkhead.

- f. After the frame is completely huck riveted, use a utility knife to remove excess dielectric tape.

**NOTE**

In a steel-to-aluminum installation, a bimetallic strip may be used in lieu of dielectric tape. However, the bimetallic strip will greatly increase the weight and moment of the installation.

600-2.5.1.3 Steel Watertight Door Panel Installation.

- a. Install the door to the frame and make adjustments. Refer to paragraph 600-2.4.2.3.2 through paragraph 600-2.4.3.8 for quickacting door installation procedures and 600-2.4.3.3 through 600-2.4.3.7 for individually dogged door installation procedures. Refer to paragraph 600-2.4.2 or paragraph 600-2.4.3 for procedures on making door dog adjustments.
- b. Conduct a chalk test. (Refer to paragraph 600-2.3.2.5.)
- c. Install a door stop and keeper.
- d. Install a door hasp and keeper, if applicable.
- e. If this is an individually dogged door, install a wrench stowage bracket to the bulkhead outside and inside the door.

600-2.5.2 Steel Watertight Door Frame and Flange Assembly Replacement.

600-2.5.2.1. Use the following procedures for replacing a flange type watertight door frame with a new flange and frame.

600-2.5.2.2 Steel Watertight Door Flange Type Door Frame Removal

- a. Cut out the door frame to be replaced. The use of a plasma cutter is recommended due to its speed and clean cutting capabilities, which reduce the grinding time required to prepare the surface for the installation. An exothermic torch can also be used for the removal.
- b. Measure approximately 10 inches from the cut and mark a zone around the edge of the cut. Ensure there are no electrical cables or other mounted parts that will prevent or hamper the installation.
- c. For a steel bulkhead, grind the area inside the 10-inch markings down to bare metal and remove any slag left by the removal cut. Also grind the deck area below the cutout approximately 3 inches from the bulkhead.
- d. Measure the distance from the deck to the bottom cut to allow extra clearance on the bottom edge of the flange.
- e. Remove the door from the door frame. Remove the dog shafts and linkage assemblies. Remove all bushings. Save all parts removed. Renew parts as required.
- f. Lay the door frame on a sheet of 3/16-inch or 1/4-inch plate. Measure the distance from the edge of the plate to the bottom edge of the door frame, allowing for the measurement taken in step d. Add 1-1/2 to 2 inches to allow the door frame and flange to overlap. Make adjustments as necessary and mark.
- g. Measure approximately 6 inches from the outside edge of the door frame on the three remaining sides of the frame and mark.
- h. Mark the door drape on all four sides in accordance with step f and step g. Also trace around the outside edge of the door frame for reference later.
- i. Remove the door frame, and measure the distance on the back side of the door frame from the edge to the

closest sleeve tube. Allow clearance for the weld bead. Add this measurement to the inside of the traced door frame mark. This will produce the area of the flange-to-frame overlap. Mark this measurement all the way around the inside of the traced door frame mark.

- j. Cut the outermost mark and innermost mark.
- k. Lay the door frame on a table or deck. Place the flange on top of the door using welding vise grip type C-clamps to hold the flange. Frame the flange and the door together while making alignments to the center flange and frame assembly. Ensure the top of the door frame and the top of the flange are at the same end before continuing.

### CAUTION

**Keep the heat even so as not to draw and warp the assembly.**

- l. Tack weld the frame to the flange at approximately eight places evenly spaced on each side of the frame/flange assembly.
- m. Fill in between the tack welds, working from one end to the other and staggering welds to prevent warping. Turn the assembly over often and weld both sides to keep the heat even.
- n. After the assembly is welded on both sides completely and has cooled, take the assembly and the door to the installation area.

#### 600-2.5.2.3 Steel Flange Type Watertight Door Frame Installation

- a. Prior to installing the frame/flange assembly in the bulkhead, rework the door to be installed for fitness. Ensure all parts are operable and have no defects. Refer to [600-2.3.2.1](#) or [600-2.3.3.1](#) for inspection procedures.
- b. Weld L-brackets in place at the most warped locations. Insert steel wedges on the flange area only and not on the door frame. Hit the wedges with a hammer to either bend the flange or pull the bulkhead out to meet the flange.
- c. When the door flange and bulkhead meet closely enough that the gap can be filled by a weld bead, weld the door in place. Spread the heat evenly to prevent drawing and warping as the welds bond the assembly to the bulkhead.
- d. After the assembly has been completely welded and all slag has been chipped, install bushings, dog shafts, and linkage assemblies. Inspect for freedom of movement.

Additional grinding may be required for clearance of assembly action. Remove dog shafts, linkage assemblies, and bushings for preservation.

- e. After all welding and grinding is completed, preserve the affected area by priming and painting.

#### 600-2.5.2.4 Steel Watertight Door Panel Installation.

- a. Install the door panel to the frame and make adjustments. Refer to paragraph [600-2.4.2.3.2](#) through paragraph [600-2.4.3.8](#) for quickacting door installation procedures and [600-2.4.3.3](#) through [600-2.4.3.7](#) for individually dogged door installation procedures Refer to paragraph [600-2.4.2](#) or paragraph [600-2.4.3](#) .for procedures on making door dog adjustments.
- b. Conduct a chalk test. (Refer to paragraph [600-2.3.2.5](#).)
- c. Install a door stop and keeper.
- d. Install a door hasp and keeper, if applicable.

- e. If this is an individually dogged door, install a wrench stowage bracket to the bulkhead outside and inside the door.

600-2.5.3 Aluminum Watertight Door and Frame Installation. This section describes procedures for cutting an opening in a bulkhead to install a watertight door, and for installing the door frame and door. Instructions for replacing an existing flange type watertight door frame with a new flange and frame are provided in 600-2.5.3.4.

#### 600-2.5.3.1 Preparation of the Bulkhead.

- a. Inspect the bulkhead for straightness. If the bulkhead is warped or twisted, straighten with a strongback. Use an angle or flat bar. If the bulkhead is bowed, make a cut in the plate. Use a strongback to flatten the bowed area and reweld the cut. See figure 600-2.76.

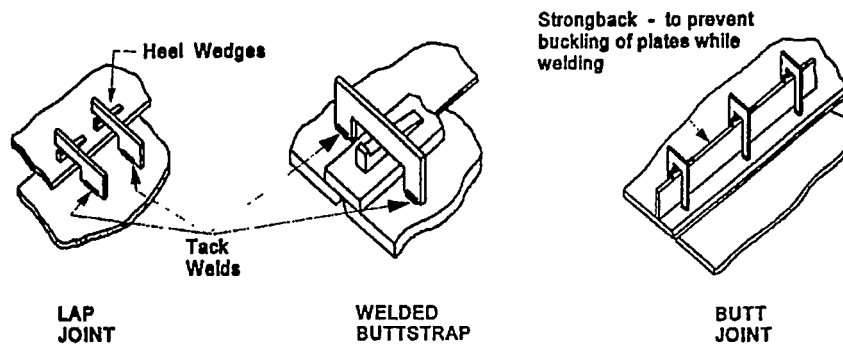


Figure 600-2.76. Methods of Securing Welded Structure

- b. If the bulkhead has no header or longitudinal T-bar at approximately 6 feet above the deck, install a new one. Locate the header 6 inches above the upper edge of the location for the clear opening of the watertight closure. Weld the entire length of the header. See BUSHIPS Drawing 805-1362325, Revision C, Reinforcement for Watertight and Airtight Door Openings.
- c. If the vertical stiffeners in the bulkhead are more than 12 inches from the location for the door frame, install chocks around the frame, one chock above and one below the intended location for each dog. Chocks must be constructed of the same material as the door frame. See BUSHIPS Drawing 805-1362325, Revision C.
- d. The area of the bulkhead that contacts the closure frame must be smooth. No welds or tacks are permitted in the lap area. For an aluminum bulkhead, use a fine flat file to remove all roughness; never grind aluminum.
- e. Prior to installing the door in the bulkhead, rework the door for fitness to be installed. Ensure all parts are operable and have no defects. Refer to paragraph 600-2.3.2.1 or 600-2.3.3.1 for door inspection procedures.
- f. Remove the door from the door frame.
- g. To mark the cutting line, have another person hold the door frame against the bulkhead in the exact location where the clear opening is to be cut. Lay out the vertical and horizontal centers of the clear opening on the bulkhead. Mark the cutting line for the clear opening. For an aluminum door, scribe the line in the plate. Remove the door frame from the bulkhead.
- h. Using an exothermic torch or plasma cutter, cut the opening for the door in the bulkhead and remove the cut panel.

### 600-2.5.3.2 Installation of the Aluminum Watertight Door Frame.

600-2.5.3.2.1 Aluminum-to-Aluminum Installation. The fit-up of the door frame to the bulkhead is to be metal-to metal. The fit-up should be uniformly tight, with no space between the frame and the bulkhead.

- a. Align the door frame over the clear opening, and use C-clamps to hold the frame in place. If this is a one person operation, tack two 2- x 2- x 1/4-inch thick plates approximately 12 inches apart to use as a ledge for the frame while clamping in place.
- b. Tack weld (skip weld) the door frame to the bulkhead every 6 inches on both sides. Keep the heat even so as not to draw and warp the assembly. Tacks on opposing sides of the fit-up should be staggered. Tacks should be approximately 1 inch in length.
- c. Fill in between the tack welds, working from one end to the other and staggering welds to prevent warping. Move from one side of the installation to the other often to keep the heat even.
- d. After the structure has been completely welded, chip away all slag.

### 600-2.5.3.2.2 Steel-to-Aluminum Installation.

- a. Align the door frame over the clear opening, and use C-clamps to hold the frame in place. If this is a one person operation, tack two 2- x 2- x 1/4-inch thick plates approximately 12 inches apart to use as a ledge for the frame while clamping in place.
- b. Drill holes for huck rivets through the frame and bulkhead. For a standard 8- or 10-dog door, drill approximately 60 holes. Drill the holes close enough to the outer edge of the door frame to avoid having huck rivets interfere with the operation of the quick-acting linkage assembly. See figure [600-2.77](#).
- c. Before installing the door frame, apply two layers (8-1/2 millimeters each, 17 millimeters total) of dielectric carrier tape to the area of the bulkhead that will be in contact with the door frame. The bulkhead must be smooth. (Refer to paragraph [600-2.5.3.1](#)) Install strips of dielectric tape along the entire edge of the clear opening. Cut curved pieces for the corners. See figure [600-2.77](#).
- d. Use C-clamps to temporarily secure the door frame to the rim of the clear opening. Install hex head bolts and nuts in enough of the rivet holes to secure the frame. Remove the C-clamps.
- e. Huck rivet the frame to the bulkhead.
- f. After the frame is completely huck riveted, use a utility knife to remove excess dielectric tape.

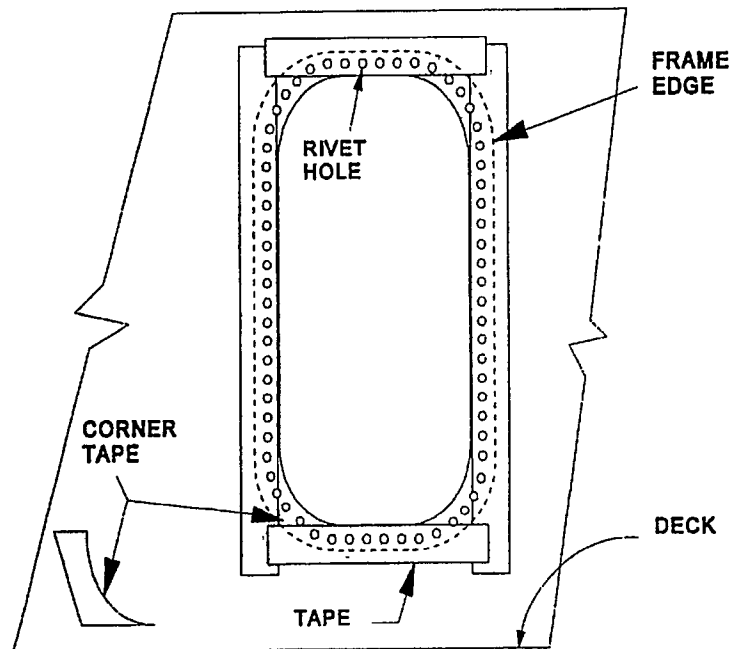


Figure 600-2.77. Dielectric Tape Installation

**NOTE**

In a steel-to-aluminum installation, a bimetallic strip may be used in lieu of dielectric tape. However, the bimetallic strip will greatly increase the weight and moment of the installation.

## 600-2.5.3.3 Aluminum Watertight Door Panel Installation

- a. Install the door to the frame and make adjustments. Refer to paragraph 600-2.5.3.2 for installation procedures. Refer to paragraph 600-2.4.2 or paragraph 600-2.4.3 for procedures on making door dog adjustments.
- b. Conduct a chalk test. (Refer to paragraph 600-2.3.2.5)
- c. Install a door stop and keeper.
- d. Install a door hasp and keeper, if applicable.
- e. If this is an individually dogged door, install a wrench stowage bracket to the bulkhead outside and inside the door.

600-2.5.4 Aluminum Watertight Door Frame/Flange Assembly Replacement. Accomplish the following procedures for replacing an aluminum flange type watertight door frame with a new flange and frame.

## 600-2.5.4.1 Aluminum Flange Type Watertight Door Frame Removal and Installation.

- a. Cut out the door frame to be replaced. The use of a plasma cutter is recommended due to its speed and clean cutting capabilities, which reduce the amount of grinding time required to prepare the surface for the installation. An exothermic torch can also be used for the removal.



- b. Measure approximately 10 inches from the cut and mark a zone around the edge of the cut. Ensure there are no electrical cables or other mounted parts that will prevent or hamper the installation.

**CAUTION**

**Use only a flat file to smooth the metal; never grind aluminum.**

- c. For an aluminum bulkhead, file the area inside the 10-inch markings down to bare metal and remove any slag left by the removal cut. Also file the deck area below the cutout approximately 3 inches from the bulkhead.
- d. Measure the distance from the deck to the bottom cut to allow extra clearance on the bottom edge of the flange.
- e. Remove the door from the door frame. Remove the dog shafts and linkage assemblies. Remove all bushings. Save all parts removed. Renew parts as required.
- f. Lay the door frame on a sheet of 3/16-inch or 1/4-inch plate. Measure the distance from the edge of the plate to the bottom edge of the door frame. Allow enough for the measurement taken in step **d**. Add 1-1/2 to 2 inches to allow the door frame and flange to overlap. Make adjustments as necessary and mark.
- g. Measure approximately 6 inches from the outside edge of the door frame on the three remaining sides of the frame and mark.
- h. Mark the door drape on all four sides in accordance with step **f** and step **g**. Also trace around the outside edge of the door frame for reference later.
- i. Remove the door frame, and measure the distance on the back side of the door frame from the edge to the closest sleeve tube. Allow clearance for the weld bead. Add this measurement to the inside of the traced door frame mark. This will produce the area of the flange-to-frame overlap. Mark this measurement all the way around the inside of the traced door frame mark.
- j. Cut the outermost mark and innermost mark.
- k. Lay the door frame on a table or deck. Place the flange on top of the door using welding vise grip type C-clamps to hold the flange. Frame the flange and the door together while making alignments to the center flange and frame assembly. Ensure the top of the door frame and the top of the flange are at the same end before continuing.

**CAUTION**

**Keep the heat even so as not to draw and warp the assembly.**

- l. Tack weld the frame to the flange at approximately eight places evenly spaced on each side of the frame/flange assembly.
- m. Fill in between the tack welds, working from one end to the other and staggering welds to prevent warping. Turn the assembly over often and weld both sides to keep the heat even.
- n. After the assembly is welded on both sides completely and has cooled, take the assembly and the door to the installation area.

#### 600-2.5.4.2 Installation of the Aluminum Watertight Door Frame/Flange Assembly.

- a. Prior to installing the frame/flange assembly in the bulkhead, rework the door to be installed for fitness. Ensure that all parts are operable and have no defects. Refer to paragraph [600-2.3.2.1](#) or paragraph [600-2.3.3.1](#) for inspection procedures.
- b. Weld L-brackets in place at the most warped locations. Insert steel wedges on the flange area only and not on the door frame. Hit the wedges with a hammer to either bend the flange or pull the bulkhead out to meet the flange.

- c. When the door flange and bulkhead meet closely enough that the gap can be filled by a weld bead, weld the door in place. Spread the heat evenly to prevent drawing and warping as the welds bond the assembly to the bulkhead.
- d. After the assembly has been completely welded and all slag has been chipped, install bushings, dog shafts, and linkage assemblies. Inspect for freedom of movement. Additional filing may be required for clearance of assembly action. Remove dog shafts, linkage assemblies, and bushings for preservation.
- e. After all welding and grinding is completed, preserve the affected area by priming and painting.

#### 600-2.5.4.3 Aluminum Watertight Door Panel Installation.

- a. Install the door to the frame and make adjustments. Refer to paragraph [600-2.5.3.2](#) for installation procedures. Refer to paragraph [600-2.4.2](#) or paragraph [600-2.4.3](#) for procedures on making door dog adjustments.
- b. Conduct a chalk test. (Refer to paragraph [600-2.3.2.5](#))
- c. Install a door stop and keeper.
- d. Install a door hasp and keeper, if applicable.
- e. If this is an individually dogged door, install a wrench stowage bracket to the bulkhead outside and inside the door.

### SECTION 3

#### ARMORED BALLISTIC CLOSURES

##### 600-3.1 BALLISTIC DOORS.

To maintain ballistic qualities and tightness of a structure, ballistic armored closures are made of the same material and the same thickness as the plating in which they are fitted. In plating 5/8-inch and thicker, door edges and the clear opening have matching 45-degree bevels to prevent closures from being driven through the openings under ballistic impact and to ensure that, when closed, closures will be near flush with the plating. See figure 600-3.1.

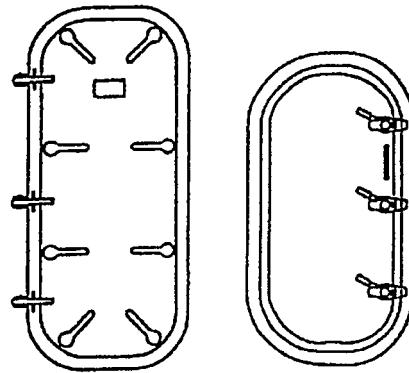


Figure 600-3.1. Armored Ballistic Closures, Individually Dogged

In plating 5/8-inch or thicker, ballistic closures have gaskets made of either two-line rubber (MIL-G-20078, Type "B") or two-line silicone rubber (FED-SPEC ZZ-R-765). The gaskets are fitted into an ordinary strength steel gasket strip welded to the closure plate. The gasket is secured to the strip with adhesive (Type MMM-AA121) and 1/8-inch by 5/8-inch flat bar, and retained by flat headed machine screws spaced approximately 5 inches center-to-center. See figure 600-3.2.

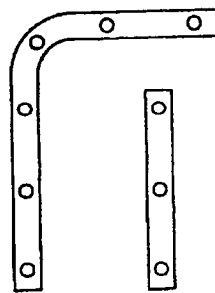


Figure 600-3.2. Gasket Retainer (Corner and Straight)

Ballistic closures located in plating less than 5/8-inch thick have gaskets (MIL-R-900) similar to those for nonballistic closures. Gasket material for closures installed in fueling areas must conform to MIL-R-15624, Class 3. See figure 600-3.3.

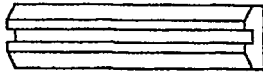


Figure 600-3.3. Gasket

Individually dogged closures in ballistic plating 5/8-inch or thicker have penetrating type dogs. Dogs and spindles are manufactured from either HY 80 steel bar (MIL-S-21952) or HTS 80 castings (MIL-S-23008). See figure 600-3.4. Dogs in ballistic plating less than 5/8-inch thick are similar in design and materials to those used on standard structural nonballistic closures. The outer end of dog spindles are either flush and slotted, or protruding and hexagonal. All ballistic closures have handles on both sides. Hinges for ballistic closures are located on the outer (exposed) side and are so designed that hinge pins (no. 2 type) will be in double shear. The weight of the closure is carried on the lower hinge. Closures weighing more than 1,000 pounds have three hinges. See figure 600-3.5.



Figure 600-3.4. Straight Handle Bushing, Dog Setscrew, and Corner Dogs

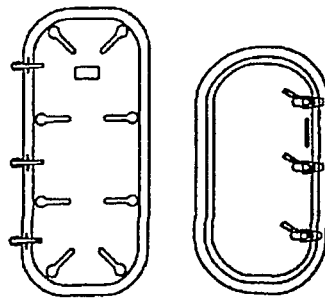


Figure 600-3.5. Armored Ballistic Closures, Tri-Hinged

### 600-3.2 REPLACEMENT PARTS FOR BALLISTIC CLOSURES.

Parts for ballistic armored watertight closures may appear similar, but will be found to vary from ship to ship (that is, different threads or overall measurements). Inquiries to commercial sources or planning yards should include as much information as possible to aid in locating proper replacement parts. The following data should be included:

- a. Ship's hull number.
- b. NAVSEA/BUSHIPS Drawing number.
- c. Sample or photograph of parts.

- d. Closure size (with the panel open, measure height and width between inner edge of frame).
- e. Quick-acting (gang-operated) or individually dogged.
- f. Number of dogs, location, and type (for example, side top corner, bottom corner, straight dog, or angle dog).
- g. Approximate thickness of the bulkhead.

600-3.2.1 Quick-Acting (Gang-Operated) Ballistic Closures. Multidog mechanisms of quick-acting ballistic closures may be grouped with connecting rods and locknuts to a turnbuckle which provides a means for adjusting the dogs to the proper position. Right-hand and left-hand threads are machined at opposing ends of connecting rods. Likewise, stainless steel or brass turnbuckle fittings have threads machined to receive the right- and left-hand threaded portion of the connecting rods. The connecting rod locknuts are machined and internally right- and left-hand threaded. The connecting rod shoulder bolts are retained by hexagonal-shaped nuts drilled to receive retaining cotter pins. A connecting rod washer is installed on each connecting rod stud and connecting rod shoulder bolt. The length of connecting rods varies with closure size. See figure 600-3.6 and figure 600-3.7.

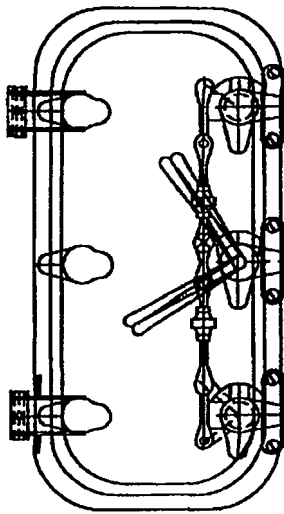


Figure 600-3.6. Quick-Acting (Gang Operated) Ballistic Closure (Open and Closed Position)

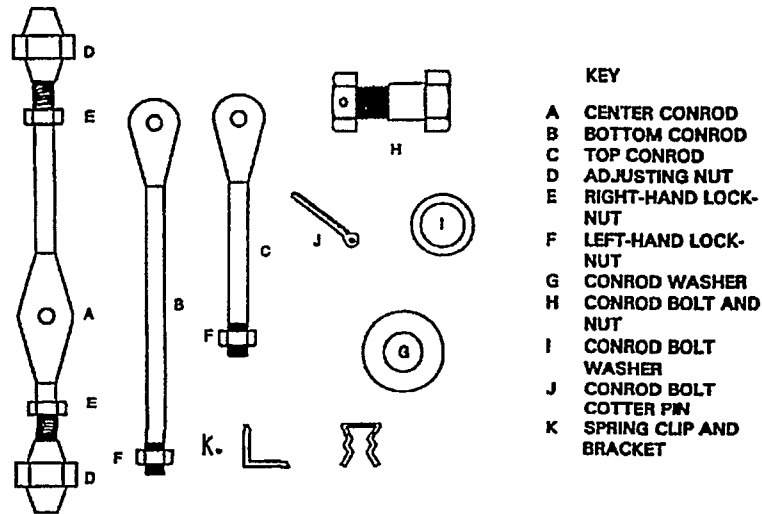


Figure 600-3.7. Linkage Assembly (Typical)

600-3.2.2 Spindles For Ballistic Closures. The top and bottom dog assemblies on a quick-acting three dog closure may use slot head spindles. The slot head provides a means of turning the spindle into the threaded door panel and additional support plate. The support plate is added to give additional thread strength to the door panel. On the same doors, the center dog may have a round head spindle or a slot head spindle. The round and slot head spindles for these closures have been modified to hex head spindles. See figure 600-3.8.

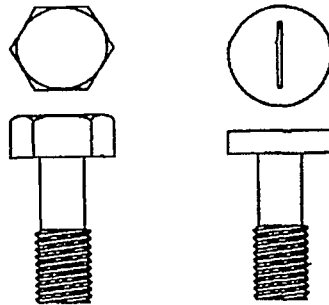


Figure 600-3.8. Spiders for Ballistic Closures

600-3.2.3 Dog Wedges. Quick-acting ballistic closures and individually dogged ballistic closures use 6-3/4-inch long aluminum bronze wedges. Shim stock is used between wedges and wedge mounting pads. Flat head brass machine screws are used to retain the wedges to mounting plates. Wedges are available in right-hand and left-hand styles. See figure 600-3.9.

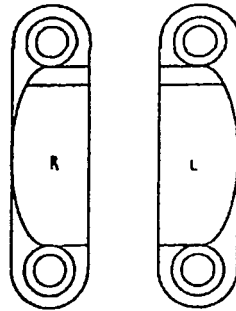


Figure 600-3.9. Dog Wedges (Right-Hand/Left-Hand)

600-3.2.4 Dogs For Ballistic Closures. The top and bottom dogs on quick-acting three-dog ballistic closures may be supported by a slot head spindle in the closure panel. In this configuration, the dog assemblies are "bushed" to the spindle. The center dog is joined to the spindle by a buttress thread. The thread joint of the dog assemblies is locked with a 1/2-13NC CRES setscrew.

In a new assembly, the spindle bearing washer is mated to the spindle shaft. The spindle and bearing washer are inserted into the opening in the closure. Dogs are mated to the spindle shaft and properly adjusted for fit.

## SECTION 4

### DOOR LATCH DEVICES

#### 600-4.1 FUNCTION.

The purpose of door latch devices is to either provide for a controlled opening of a door where air pressure differential would normally cause the door to slam open or closed (Collective Protective System (CPS) latch) or to allow personnel to properly close a 3-dog, quick-acting airtight door with one hand (dog assist latch).

#### 600-4.2 DESCRIPTION.

600-4.2.1 Collective Protective System Latch (MACHALT 167-53008 (ECP-523)). The Naval Surface Warfare Center, Carderock Division - Ship Systems Engineering Station (NSWCCD-SSES), style CPS latch is similar to a common gate latch. This latch is installed on doors of airlocks/pressure locks which are generally located in boundaries of CPS zones. This latch provides positive engagement by use of a latch bar and either a straight or ramped keeper. Both the latch bar and the keeper have a stellite coating applied to the contact surfaces to reduce wear. When the door is undogged, the door opens several inches before the latch bar hits the stop on the keeper and allows pressure on both sides of the door to equalize.

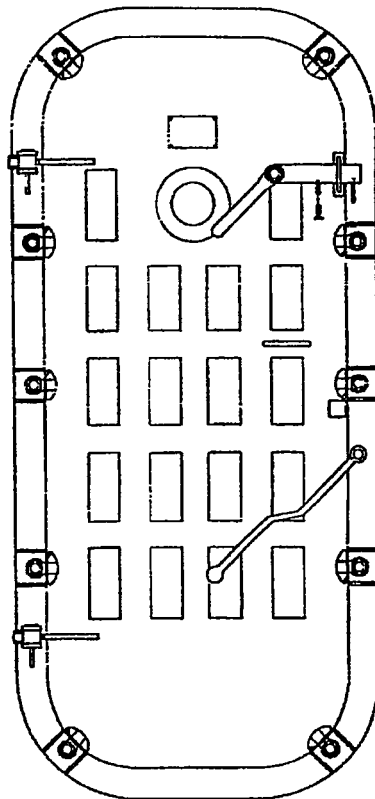


Figure 600-4.1. Door Latch Device

600-4.2.2 Dog Assist Latch (MACHALT 167-53009 (ECP-514)). The dog assist latch, which is similar to the CPS latch, is installed on 3-dog, bound hinge airtight doors. As the description indicates, this latch is designed to assist personnel in properly closing and dogging airtight doors. These doors, when properly adjusted, start to compress the gasket on the hinge side as the door swings to close. Typically, this generates a significant amount



of resistance when the handle side of the panel is held closed against the knife-edge. Usually, the use of both hands is required to properly dog the door. In most cases, the door panel is not held tightly against the knife-edge prior to dogging the door. This results in the dogs striking the side of the door panel, causing structural damage to the panel and accelerated wear on the wedges. The dog assist latch provides a means of holding the door panel in the properly closed position (against the knife-edge) while dogging the door, thereby eliminating the need to use both hands. The only difference between the CPS latch and the dog assist latch is the length of the keeper. The CPS latch, when engaged, allows free movement of the door panel in order to facilitate pressure relief, whereas the dog assist latch is set to engage the keeper when the handle side gasket first contacts the knife-edge.

### **600-4.3 REPLACEMENT PARTS.**

With the exception of the keeper, parts for the CPS latch and the dog assist latch are identical, and are illustrated in figure 600-4.2. The latch is designed to require little maintenance. The two flanged bushings used are self-lubricating and are the exact same bushings used in the quick-acting door operating handle sleeve. The bushings are equipped with an external O-ring and an internal T-seal to provide a watertight seal for the spindle sleeve. The commercial off-the-shelf type extension spring is externally mounted and easily repaired or replaced. All components of the latch assembly are CRES 316 and do not require preservation. Replacement parts are available in the Navy Stock System and can be identified on the applicable Allowance Parts List (APL).

### **600-4.4 INSPECT, CLEAN, AND LUBRICATE LATCH DEVICES (MACHALT 167-53009 (ECP-514) AND MACHALT 167-53008 (ECP-523)).**

600-4.4.1 Safety. Before repairing any door latch device, obtain permission from the Engineering Officer to disable the door. Make an appropriate entry in the ship's closure log. Check with supervisor before starting work. Do not disassemble any door latch device while the ship is underway; perform only those emergency repairs required to keep that particular door operational. Fasten or lash back any door which must remain open while work is being accomplished to prevent the door from swinging as the ship rolls. If possible, try to start and finish repair on the door in the same workday. This will prevent having an additional open closure after working hours when fewer crewmen are on board. Have on hand all parts required to repair the latch device before starting work. Notify a supervisor when the repairs are completed. Clear the entry in the ship's closure log.

600-4.4.2 General Guidance for Inspections. The following principles apply to inspections for all watertight and airtight closures:

- a. Comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series, which is found in each work center.

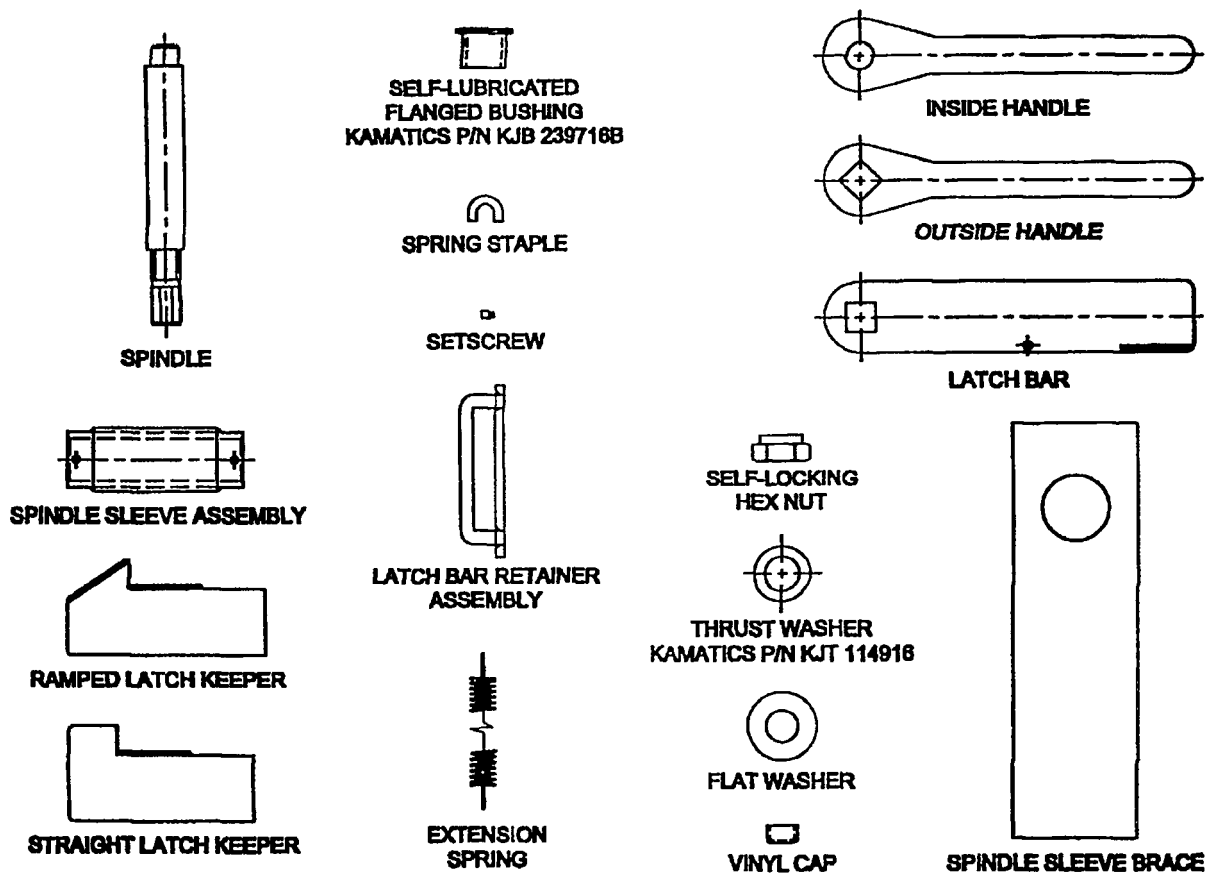


Figure 600-4.2. Latch Device Assembly Replacement Parts

- b. All tag-out procedures shall be in accordance with current shipboard instructions.
- c. Accomplish inspection and maintenance in accordance with applicable Planned Maintenance System (PMS) documentation.
- d. Replace loose, missing, or damaged parts, and parts showing excessive wear.
- e. Latches should be routinely inspected by Damage Control Petty Officers and Zone Inspectors for:
  1. Loose, missing, and damaged parts.
  2. Paint, rust, and other foreign matter on working parts such as flanged bushings.
  3. Binding and difficult operation.
  4. Distortion and deterioration of metal surfaces.
  5. Broken and missing springs.

If any parts are missing or beyond repair, replacement parts can be obtained through the Navy Stock System. Additional assistance can be provided by NSWCCD-SSES, Attn: Code 9782, Philadelphia, PA, Hull Outfitting, DSN 443-7344, Commercial (215) 897-7344.

#### 600-4.4.3 Inspect, Clean, And Lubricate.

##### 600-4.4.3.1 Visual Inspection.

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**WARNING**

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

- a. Deenergize applicable CPS supply and exhaust fans, and tag "Danger: Out of Service." Shut door to be inspected.
- b. See figure 600-4.2 and figure 600-4.3 for identification of components, and inspect latch for the following:
  1. Paint, rust, or other foreign matter on spindle, flanged bushings, setscrews, thrust washers, spindle sleeve, flat washer, self-locking hex nut, extension spring, and contact areas of working parts.
  2. Distortion, damage, or deterioration of any components.
  3. Obstructions in way of access to latch device and obstructions which interfere with operation of latch device.

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**CAUTION**

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**Ensure that thrust washers are installed between the contact surface of the flanged bushings and the inside and outside handles. Missing thrust washers will result in damage to the self-lubricating lining on the flanged face of the bushing.**

4. Loose or missing self-locking nut, flat washer, and thrust washers on latch spindle.
5. Loose or missing setscrews for flanged bushings. Setscrews should be flush or slightly recessed in spindle sleeves and tight.
6. Missing or stretched extension spring, and missing or damaged spring staple. Ensure that spring loop ends are crimped closed around latch bar and spring staple.

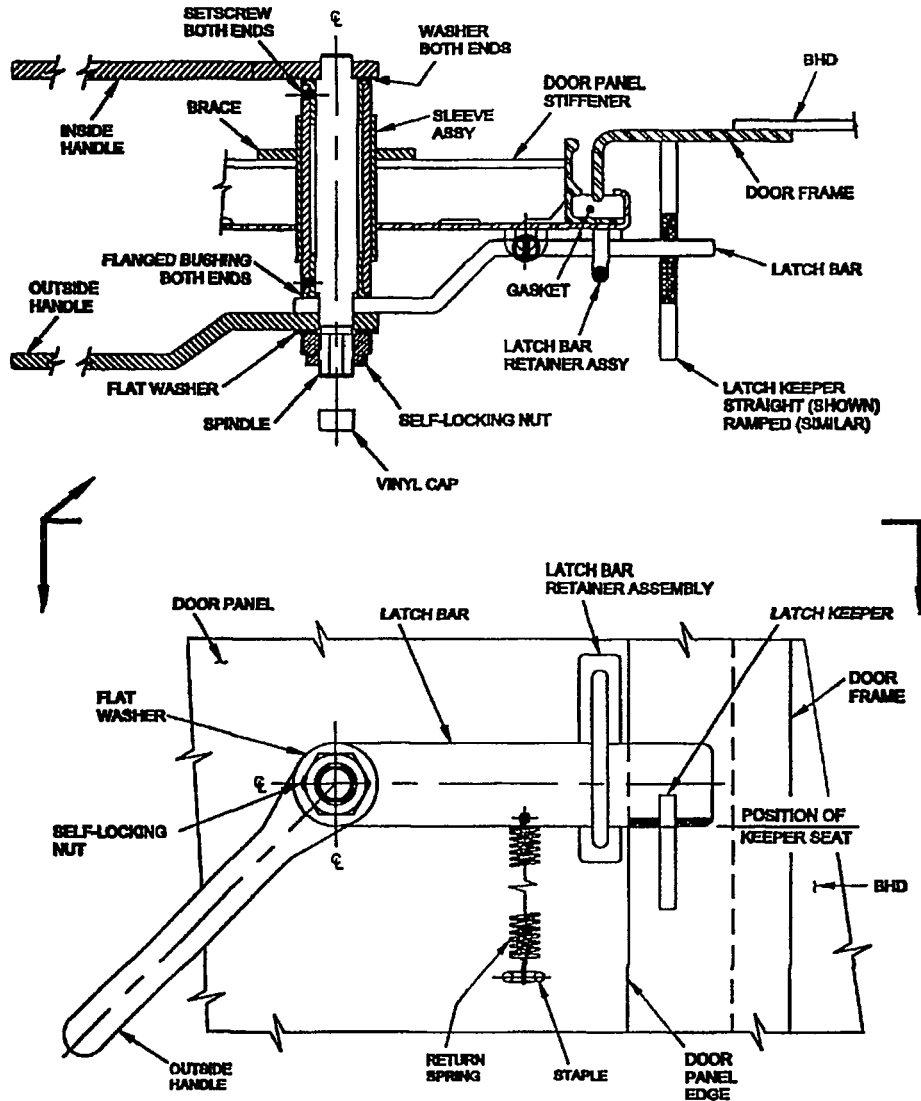


Figure 600-4.3. Latch Device

7. Missing or damaged inside handle, outside handle, latch bar, latch bar retainer, latch keeper, and slide bar.
8. Worn stellite coating on latch bar and latch keeper. The coating shall be considered worn out when 3/32-inch of material has been lost from the original 1/8-inch thick coating.
9. Cracked or broken welds on spindle sleeve, sleeve brace, inside handle, latch keeper, spring staple, latch bar retainer, and slide bar.
10. Loose or flaking paint and rust on door panel at spindle sleeve penetration and in the immediate vicinity of latch bar retainer, slide bar, and spring staple.
11. Latch handles interfering with the proper operation of the darken ship covers over fixed lights.

**WARNING**

**Ensure a minimum 2-inch hand clearance exists between the door dogging handle and any latch device component.**

12. Latch device assembly does not interfere with operating door dogging handle.
13. Operate latch device through latch/unlatch cycle, and inspect for binding or excessive play between spindle, spindle sleeve, and flanged bushings. When the handle is released, the latch bar should return to latched position. Binding can be caused by overtightening self-locking nut, friction between contact surfaces of latch bar and retainer/slide bar, or no lubrication on O-rings in flanged bushings. Excessive play indicates worn flanged bushings or improperly tightened self-locking nut.
14. Inspect for worn flanged bushings. Grasp inside handle (handle welded to spindle), and attempt to shake it up and down, and side to side. If movement occurs, bushings are worn. In and out movement is not an indication of worn bushings, but an indication of an overtightened self-locking nut.
15. For doors installed with square latch keepers, close door from open position. Ensure that latch bar contacts vertical face of latch keeper and prevents door from fully closing until latch bar is raised to unlatch position.
16. For doors with ramped latch keepers, close door from open position. Ensure that latch bar contacts ramped (sloped) section of latch keeper and travels up and over keeper, allowing door to close fully. If latch bar contacts the vertical portion of keeper, either the door panel has dropped because of worn hinge washers and hinge pins or the latch assembly was not properly aligned when installed.

#### 600-4.4.3.2 Clean and Lubricate.

- a. Remove vinyl cap, self-locking hex nut, and flat washer from spindle.

#### CAUTION

**Do not allow latch bar to hang freely, supported only by the extension spring, as damage to extension spring may occur. Support latch bar with extension spring by taping it to the door panel with duct tape.**

- b. Remove outside handle, latch bar, and thrust washer.

#### WARNING

**Respiratory protective equipment must be worn if exhaust ventilation (fixed or portable) is not in operation or is inadequate. If unsure whether ventilation is adequate, consult work center supervisor.**

- c. Remove spindle from spindle sleeve assembly. Retain spindle CRES thrust washers for reinstallation.
- d. Remove setscrew from self-lubricated flanged bushings.
- e. Remove self-lubricated flanged bushings.

#### WARNING

**Wear safety goggles when wire brushing with power drill.**

- f. Clean contact surfaces of latch bar, latch keeper, slide bar, and latch bar retainer with aluminum oxide abrasive cloth, no. 320 grit, or wire wheel only if paint or rust exists. Use clean rag to remove abrasive grit remaining on components.
- g. Clean self-lubricated flanged bushings with clean, dry rag. Inspect external O-ring, internal T-seal, and bearing liner for wear or damage.
- h. Clean inside surface of spindle sleeve assembly and surface of spindle using a rag.

**CAUTION**

**Under no circumstances should abrasive cloth, wire brush, or metal scraper be used to clean latch spindles, inside surface of spindle sleeves, or thrust washers, as this will damage machined surfaces of these components.**

- i. Clean surfaces of latch spindle, inside surface of spindle sleeve assembly, and thrust washers with crocus cloth only if paint or surface rust exists. Use clean rag to remove grit or debris.
- j. Inspect for nicks or burrs on spindle and in spindle sleeve assembly in flanged bushing contact area. If found, file smooth. Use clean rag to remove grit or debris.
- k. Inspect for damaged or stripped threads on spindle. If found, chase threads with rethreading die.
- l. Reinstall self-lubricated flanged bushings.
- m. Reinstall setscrews into self-lubricated flanged bushings.
- n. Reinstall spindle into spindle sleeve assembly.
- o. Reinstall thrust washer, latch bar, and outside handle.
- p. Reinstall flat washer and self-locking hex nut on spindle.
- q. Reinstall vinyl cap onto threads of spindle.

## SECTION 5

### NON BALLISTIC HATCHES

#### 600-5.1 OVERVIEW.

A hatch is defined as an access opening in the deck of the ship, fitted with a hatch cover for watertight closure. Emphasis is on the cover. The hatches covered in this subsection include raised watertight, raised watertight with scuttles, raised quick acting spring balanced, flush and ramped low profile watertight, flush watertight and ramped low profile (2722 kg (6000 lb.) wheel load).

600-5.1.1 Steel, Raised Watertight Hatches (Figure 600-5.1). Raised steel watertight hatches are built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE
BUSHIPS 805-1624070	30" x 36"
BUSHIPS 805-1624073	30" x 48"
BUSHIPS 805-1624074	30" x 48"
BUSHIPS 805-1624075	30" x 60"
BUSHIPS 805-1624076	30" x 60"
BUSHIPS 805-1624077	36" x 42"
BUSHIPS 805-1624078	36" x 42"
BUSHIPS 805-1624079	36" x 60"
BUSHIPS 805-1624080	36" x 72"
BUSHIPS 805-1624081	42" x 48"
BUSHIPS 805-1624082	48" x 48"
BUSHIPS 805-1624083	60" x 60"
BUSHIPS 805-1624084	60" x 60"
BUSHIPS 805-1624085	72" x 72"
BUSHIPS 805-1624086	72" x 72"
BUSHIPS 805-1624090	24" x 24"
BUSHIPS 805-1624091	30" x 30"
BUSHIPS 805-1624093	30" x 30"
BUSHIPS 805-1624144	24" x 30"

These hatches are installed in interior and exterior areas where rapid access/egress is not required. They are normally found in a low traffic area and offset in a corner of a passageway or compartment. These hatches are usually installed in compartments that provide egress by other means, as they do not have escape scuttles. They are usually used for stores and ordnance onload/offload, and access for large or heavy equipment.

600-5.1.2 Steel, Raised Watertight Hatches with Scuttles (Figure 600-5.2). Raised watertight hatches with scuttles [scuttle size 45.7cm (18") diameter] are built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE
BUSHIPS 805-1624087	30" x 36"
BUSHIPS 805-1624088	36" x 42"
BUSHIPS 805-1624089	36" x 60"
BUSHIPS 805-1624091	30" x 30"
BUSHIPS 805-1624093	30" x 30"
BUSHIPS 805-1624138	72" x 72"

- Continued

DRAWING	SIZE
BUSHIPS 805-1624139	36" x 72"

The use of 18" diameter scuttles in hatches is being avoided for new construction. The recommended minimum size scuttle installed in a hatch is 21" diameter. To date, there have been no NAVSEA standard drawings developed for hatches with 21" scuttles installed. Thus, when hatches with 21" scuttles are required, a modification statement must be provided when referring to the above drawings. These hatches are installed in interior and exterior areas where rapid access/egress is required. These hatches are usually provided in higher traffic areas than the raised watertight hatches, and are offset in a corner of a compartment or along a passageway. These hatches have escape scuttles to provide rapid access/egress. They are usually found above berthing compartments, machinery spaces and all deck levels requiring rapid access/egress. Large hatches with QA scuttles are provided for routine access in way of inclined ladders.

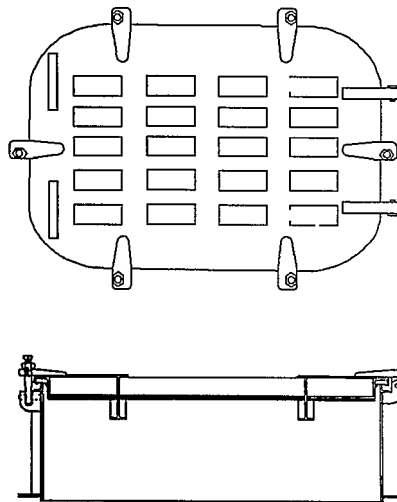


Figure 600-5.1 Raised Watertight Hatch



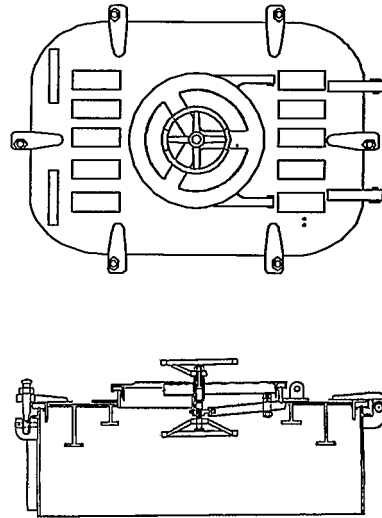


Figure 600-5.2 Raised Watertight Hatch with Scuttle

600-5.1.3 Steel, Raised Quick Acting Spring Balanced Hatches (Figure 600-5.3). Raised quick acting spring balanced hatches are equipped with counter-balance torsion springs on the hinge assembly to allow the hatch to be easily opened from below by one person, with a lifting force within the limits specified in ASTM-F 1166 for the 5<sup>th</sup> percentile person. These hatches are normally installed in machinery space escape trunks. Raised spring balance hatches are built in accordance with drawings, NAVSEA 803-1645097, or NAVSEA 803-5184172.

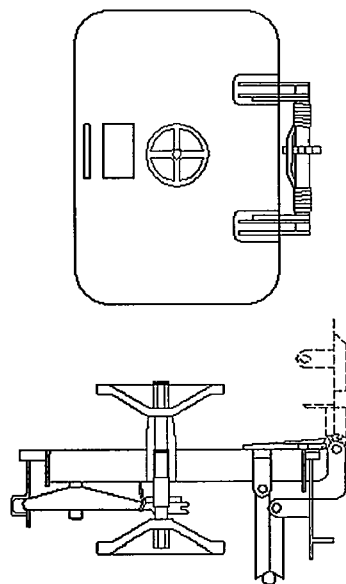


Figure 600-5.3. Raised Quick Acting Spring Balanced Hatch

600-5.1.4 Steel, Flush (Figure 600-5.4) and Ramped Low Profile Watertight Hatches (Figure 600-5.4 and Figure 600-5.5). Flush and ramped, low profile individually dogged hatches are built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE
NAVSEA 803-1624094*	30" x 30"
NAVSEA 803-1624095*	30" x 36"

- Continued

DRAWING	SIZE
NAVSEA 803-1624096**	30" x 48"
NAVSEA 803-1624097**	30" x 60"
NAVSEA 803-1624098**	36" x 42"
NAVSEA 803-1624099**	36" x 60"
NAVSEA 803-1624100*	36" x 72"
NAVSEA 803-1624101**	42" x 48"
NAVSEA 803-1624102*	48" x 48"
NAVSEA 803-1624103*	60" x 60"
NAVSEA 803-1624104*	72" x 72"
NAVSEA 803-1624108*	30" x 36"
NAVSEA 803-1624109*	30" x 48"
NAVSEA 803-1624110*	30" x 60"
NAVSEA 803-1624111*	36" x 42"
NAVSEA 803-1624112*	36" x 60"
NAVSEA 803-1624113*	36" x 72"
NAVSEA 803-1624114*	42" x 48"
NAVSEA 803-1624115*	48" x 48"
NAVSEA 803-1624116*	60" x 60"
NAVSEA 803-1624117*	72" x 72"
NAVSEA 803-1624118*	30" x 30"
NAVSEA 803-1624141***	24" x 30"
NAVSEA 803-1624142*	24" x 30"
NAVSEA 803-1624143*	24" x 30"

\*Flush type only. Not spring balanced

\*\*Flush & ramped low profile type. Only ramped low profile type is spring balanced.

\*\*\*Flush & ramped low profile type. Not spring balanced.

These hatches are installed in areas such as flight decks, hangar decks, cargo decks, passageways or areas of relatively high traffic where a flush deck condition is required to eliminate tripping hazards or to maintain a smooth trucking surface. Trough drains are required for flush hatches in weather decks. Whenever possible, ramped low profile hatches are preferred over flush hatches in weather decks, as they eliminate the problem of corrosion and debris that usually accumulate in the trough area and recessed hinge pockets of flush hatches. Ramped low profile hatches also eliminate the need for trough drains in weather deck areas. The hatches listed above are not specifically designed for use in areas subjected to wheel loads from heavy vehicle traffic. Calculations shall be performed to verify the adequacy of the hatch to withstand any vehicular wheel loads that may be incurred. For hatches subject to heavy wheel loads, see [600-5.1.5](#).

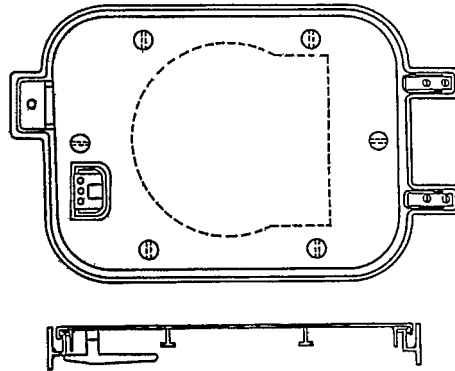


Figure 600-5.4 Flush Watertight Hatch

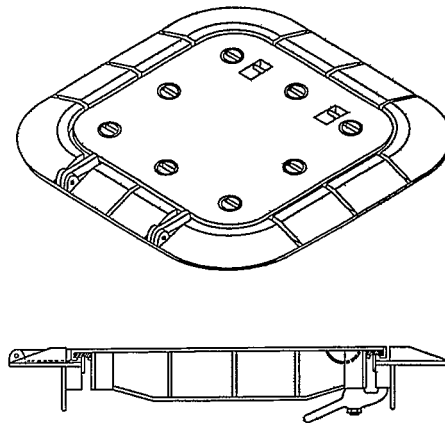


Figure 600-5.5 Ramped Low Profile

600-5.1.5 Steel, Flush Watertight Hatches (2722 Kg (6000 lb.) Wheel Load) and Ramped Low Profile Hatches (2722 Kg (6000 lb.) Wheel Load) - (Figure 600-5.6). With the exception of 24" x 30" hatches, these hatches are spring balanced and built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE
NAVSEA 803-5959173	42" x 48"
NAVSEA 803-5959174	36" x 42"
NAVSEA 803-5959175	36" x 60"
NAVSEA 803-5959176	24" x 30"
NAVSEA 803-5959177	30" x 30"
NAVSEA 803-5959178	30" x 48"
NAVSEA 803-5959179	30" x 36"
NAVSEA 803-5959180	30" x 60"

They are normally installed in areas such as flight decks, hangar decks, cargo decks, passageways or areas of high traffic that may be subject to wheel loads of up to 2722 kg (6000 lb.). Where wheel loads may exceed 2722 kg (6000 lb.), the hatch assembly should be reinforced as necessary to withstand the applicable wheel loads. For exterior installations, flush hatches are to be provided with trough drains. Ramped low profile hatches are installed in areas where a minimum height ramped hatch would not be detrimental to shipboard vehicular traffic or pose a tripping hazard. Whenever possible, ramped low profile hatches are preferred over flush hatches, as they eliminate the problem of corrosion and debris that usually accumulate in the trough area and recessed hinge

pockets of flush hatches. Ramped low profile hatches also eliminate the need for trough drains in weather deck areas.

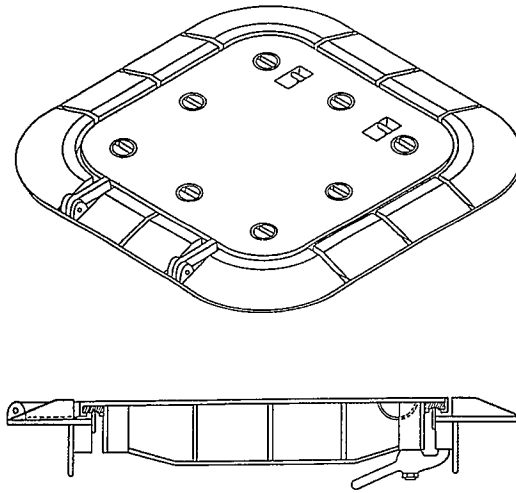


Figure 600-5.6. Ramped Low Profile Hatch (2722 Kg (6000 Lb.) Wheel Load)

#### 600-5.2 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 paragraph [600-2.3.2.3](#) and paragraph [600-2.3.2.4](#).
- c. Accomplish the chalk test in accordance with paragraph [600-2.3.2.5](#).
- 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 [600-5.7](#).

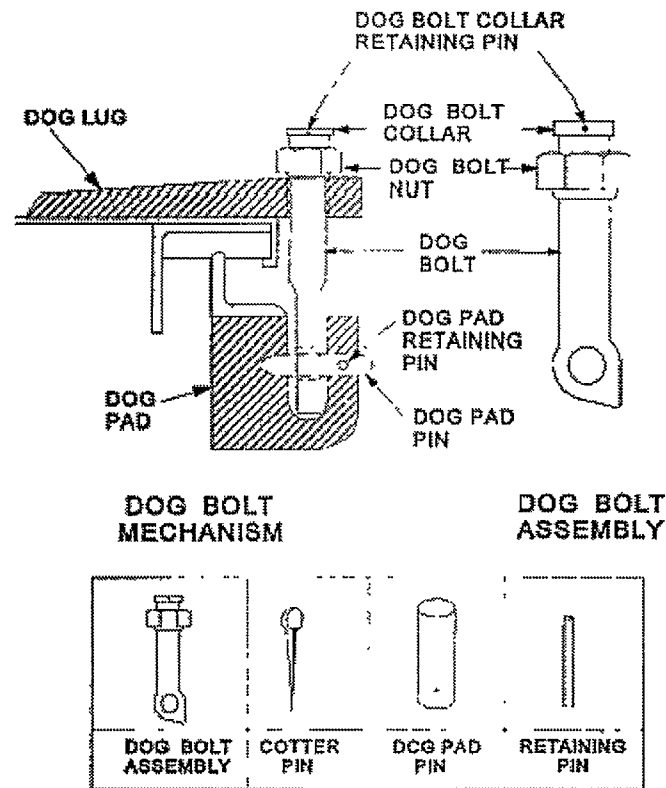


Figure 600-5.7 Dog Bolt Assembly

- 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 combing. 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 puffing 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 [600-5.8](#).

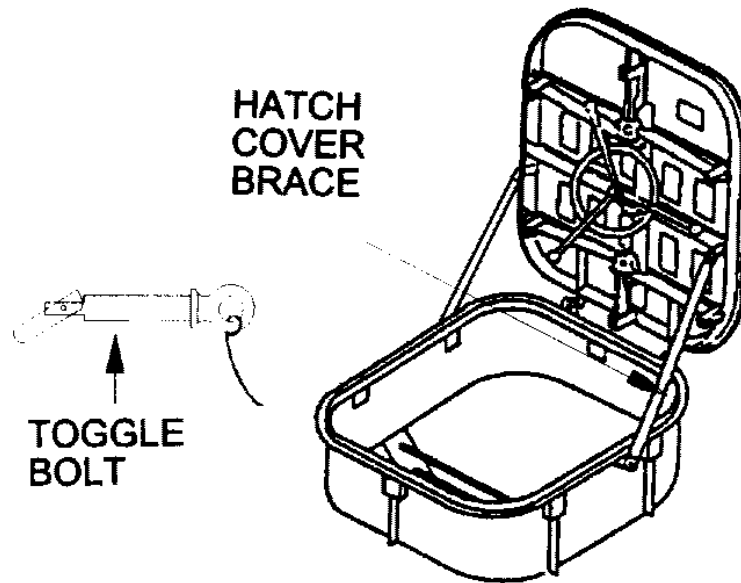


Figure 600-5.8 Hatch Cover Brace and Toggle Link

- 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.

**600-5.2 HATCH REPAIR.**

600-5.2.1 If routine maintenance is not sufficient to restore a watertight hatch to watertight or operating condition, repair or replace defective parts.

600-5.2.2 Hinge Pin Replacement. Hinge assemblies for hatches tend to be more wobbly than door hinges, even in new construction. For this reason, inspecting the hinge assembly by operating the hatch does not necessarily reveal hinge pin wear. It is good practice to periodically remove the hinge pins and visually inspect for damage. To remove a hinge pin, first remove the cotter pin that holds it in place. Remove the hinge washer and slide the hinge pin out of the hinge pad. See figure 600-5.9. Replace all worn hinge pins and hinge washers.

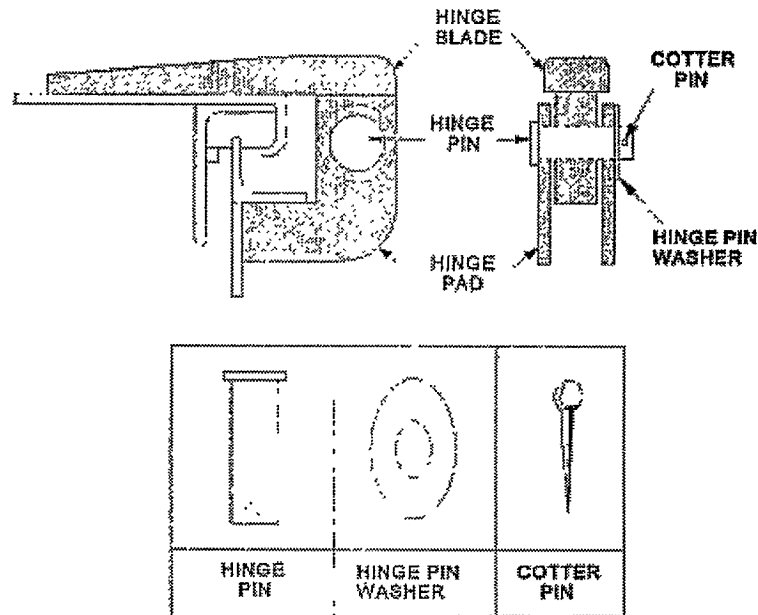


Figure 600-5.9 Watertight Hatch Hinge Assembly

### 600-5.2.3 Dog Bolt Repair.

600-5.2.3.1 Dog Bolt Nut Replacement. The dog bolt (drop bolt) nut must be replaced if it is damaged or missing. The nut may be out-of-round from being hit by heavy equipment, or the threads may be bad. Using a 1/8-inch drive pin punch, drive out the collar retaining pin from the top of the dog bolt. Remove the collar and nut by backing off the nut all the way. The nut will push the collar off the dog bolt. Attach a new nut, boss side down. Reinstall the collar and retaining pin. See figure 600-5.10.

#### NOTE

A retaining pin can be fabricated by using 1/8-inch diameter brazing rod. Cut the rod approximately 1/8-inch longer than required length. Insert the rod andpeen over the ends with a hammer to hold in place.

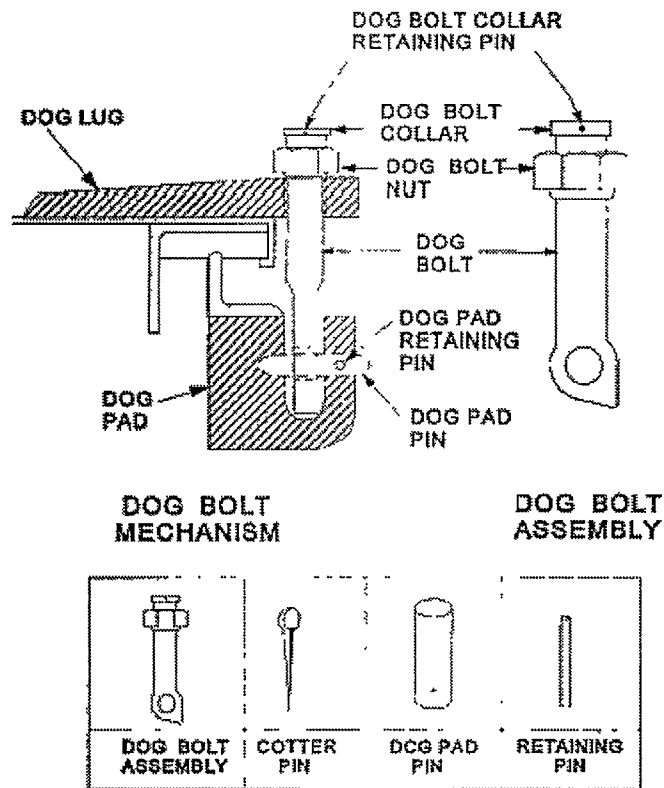


Figure 600-5.10. Watertight Hatch Dog Bolt Mechanism

600-5.2.3.2 Dog Bolt Replacement. Dog bolts can become bent if all are not loosened sufficiently when the hatch is raised. Replace dog bolts which are bent or which have an elongated hole or stripped threads. Hatch dog bolts are either shipped from the factory or ordered as replacements through the Federal Stock System, are made of mild steel. Mild steel dog bolts are sufficient for use on hatches located within the weather envelope. However, these bolts rust and corrode. For hatches located on weather decks, use replacement dog bolts made of stainless steel. Stainless steel dog bolts are available from commercial watertight fitting parts suppliers.

600-5.2.3.2.1 To replace a dog bolt:

- a) Using a 3/32- or 1/8-inch drive pin punch, remove the retaining pin from the dog pad pin.
- b) With a combination square or rule, locate and center punch the inside of the hatch coaming at a point over the approximate center of the end of the dog pad pin.
- c) Drill a 1/8-inch diameter hole through the coaming. Insert a 1/8-inch diameter punch, and drive out the dog pad pin. See figure 600-5.11.
- d) Remove the damaged dog bolt.
- e) Install the new dog bolt into the slot in the dog pad. Ensure the protrusion or bulge that is cast into one side of the bottom of the bolt faces towards the back of the slot in the hatch cover. If the bolt is installed backward, the dog bolt will not swing fully away from the dog pad when the hatch is lifted.
- f) Replace the dog pad pin. Align the holes for the retaining pin with the holes in the dog pad pin. Install the retaining pin.



**CAUTION**

**Do not grind the weld flush.**

- g) Weld up the 1/8-inch hole previously drilled in the hatch coaming with a 1/8-inch diameter E6010 or E6011 electrode.
- h) Coat the dog bolt threads with a thin coat of grease.

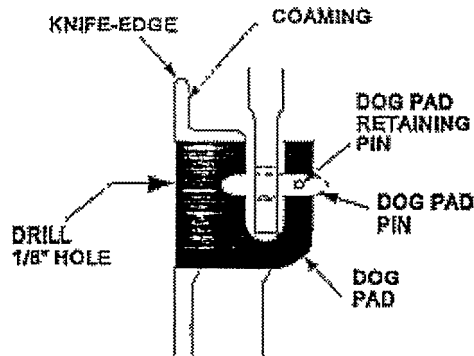


Figure 600-5.11. Removing Dog Pad Pin

**600-5-3. QUICK-ACTING HATCH REPAIR.**

600-5.3.1 Quick-acting hatches have a handwheel assembly similar to those on scuttles. For instructions on handwheel disassembly and repair, refer to Section 7, paragraph [600-7.3](#).

## SECTION 6

### BALLISTIC HATCHES

#### 600-6.1 OVERVIEW

600-6.1.1. These hatches are installed in a ballistic armored deck. They are spring balance counterweighted or hydraulic operated. An automatic catch assembly holds the hatch open. The hatch and deck are of the same material and thickness.

600-6.1.2 Flush ballistic hatches are of the same material and thickness as the deck in which they are installed. In the case of multiple course decks, hatches are constructed of the same material as the upper course and are the same thickness as the total deck thickness. Flush hatches in ballistic decks are usually dog type and spring balanced. Hatches that are not spring balanced are operable from the upper side of the deck only. These hatches are opened and closed with hand-operated chain hoists, unless a power hoist is installed near the hatch for moving stores or other material through the hatchway. See figure 600-6.1.

#### 600-6.2 BALANCED BALLISTIC HATCHES.

600-6.2.1 The edges of flush ballistic hatches and the deck plating in which they are installed have matching 45-degree bevels. The top of the hatch is fit practically flush with the top of the deck plating (or with the top of the landing strip, if installed). In order to allow for compression of the gasket, the clearance between the closed hatch cover and deck plating in way of the bevel is approximately 1/8 inch measured vertically. The hatch is not rabbeted or otherwise recessed to facilitate securing the gasket.

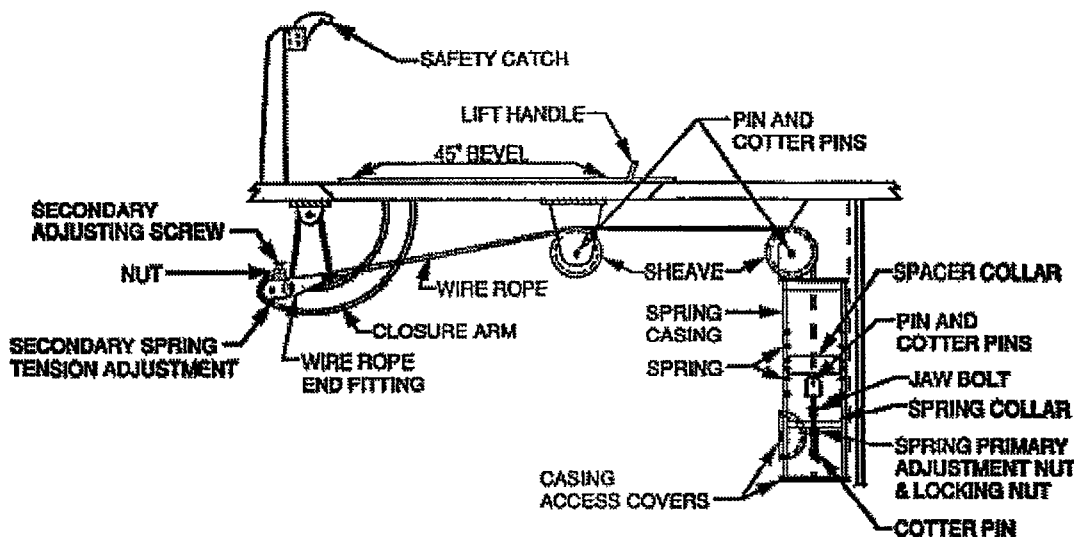


Figure 600-6.1. Typical Hatch

600-6.2.2 Springs and other parts for balanced hatches are designed so the hatch is as balanced as possible in all positions. The force of the spring is sufficient to allow one person to open or close the hatch easily from above or below. Hatches without lift handles are slightly overbalanced. These hatches should raise toward open slightly when undogged and require a moderate amount of downward pressure to dog down. Hatches with lift handles should be balanced to allow free fall slowly toward closed, but not slam. The hatch should slow and stop just before gasket and seating surface contact (2 to 6 inches). See figure 600-6.1.

600-6.2.3 Ballistic hatch springs are the compression type (spring steel, Grade II, Type B, Material 7) and have three-quarters of a coil on each end squared and ground smooth. The springs, spring plate, filler plate, and jaw bolt assembly are fitted within a metal enclosure (spring casing) having a casing head assembly, end cover, and hand-hole cover. Ballistic hatch spring plates and spring filler plates are part of the spring assembly of most ballistic armor hatches which use two coil springs. Two springs are used instead of one to avoid buckling which is likely to occur during the compression of a single spring. The filler plate is located between the two coil springs to provide a smooth surface for the squared ends of the springs. The spring plate is located at the base of the spring assembly. This plate is secured in place on the threaded end of the jaw bolt by an adjusting nut, locknut, and cotter pin. The adjusting nut provides the primary means for bringing the hatch into balance, and the purpose of the locknut is to lock the adjusting nut in place. The cotter pin installed near the end of the threaded portion of the jaw bolt is to prevent inadvertent loss of the adjusting nut or locknut. Access to the primary adjustment nut, locknut, and cotter pin is made by removing the handhole cover and casing end cover which are affixed to the spring casing by 10-24NC x 1/4-inch long machine screws. See figure 600-6.2. The secondary means of bringing the hatch into balance is with the secondary spring tension adjustment bolt located on the hinge arm. To decrease spring tension, loosen the adjustment bolt locknut and rotate the adjustment bolt clockwise until desired tension is achieved. Counterclockwise rotation of the adjustment bolt will increase spring tension. The adjustment bolt locknut prevents inadvertent movement of the adjustment bolt when locked in place. See figure 600-6.2.

### 600-6.3 SHEAVES.

600-6.3.1 Sheave assemblies are used to reduce wire rope friction to a minimum. Graphite bronze bushed sheaves with cold rolled steel pins, steel washers, and steel cotter pins are fitted to sheave brackets welded to casing head plates and to chocks at other suitable locations along the wire rope path of travel. The number of sheave assemblies installed will depend on the overall length of the wire rope and/or the number of bends along the wire rope path of travel. See figure 600-6.2.

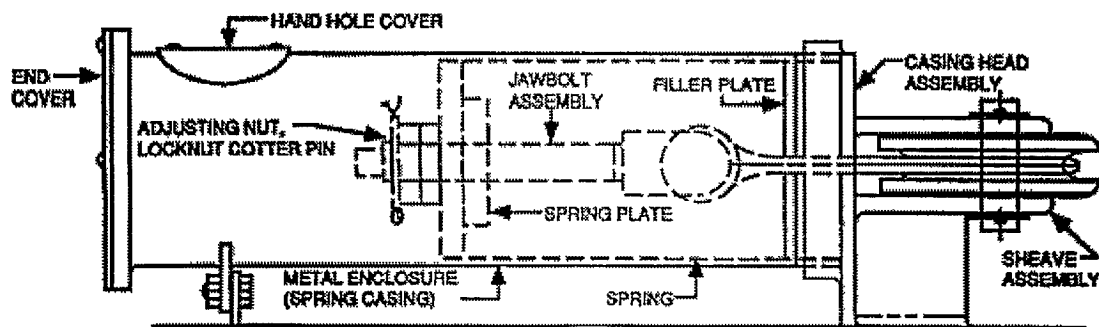


Figure 600-6.2 Spring Casing Assembly

### 600-6.4 WIRE ROPE ASSEMBLIES.

600-6.4.1 Jaw bolt and clevis end wire rope socket electroline fiege fittings are used in wire rope assemblies on ballistic armor hatches. Navy drawings of wire rope assemblies show the fittings and are listed in the bill of material as "clevis end w.r. socket" and "stud end w.r. socket". The diameter of the fiege fittings depends on the hatch size and the cover thickness. The diameter and type of wire rope used in wire rope assemblies also depends on hatch size and the cover thickness. The material specifications are listed in the drawing bill of material for each type hatch and class ship. The 3/8-inch diameter wire rope (6 x 37) is preformed, fiber core, improved plow steel, galvanized, in accordance with material specification RR-W-410, Type 1, Class 3. The 1/2-inch diameter wire rope is the same type and specification. The 5/8-inch diameter wire rope (6 x 37) is preformed, internal wire rope core, extra improved plow steel, galvanized, in accordance with material specification RR-W-410, Type 1, Class 3. Complete wire rope assemblies (wire rope, jaw bolt, and clevis end wire rope socket) are to be tested in accordance with the current Naval Sea Systems Command Technical Manual (NSTM), Chapter 613, by a cer-

tified weight testing facility. A certificate must be issued, and an approved type test label must be attached to the wire rope at the location specified on the drawing. The entire wire rope must be lubricated with hatch in the open and closed positions to ensure all surfaces of the wire rope are properly lubricated as specified in current Planned Maintenance System Maintenance Requirement Card. See figure 600-6.2 and figure 600-6.3

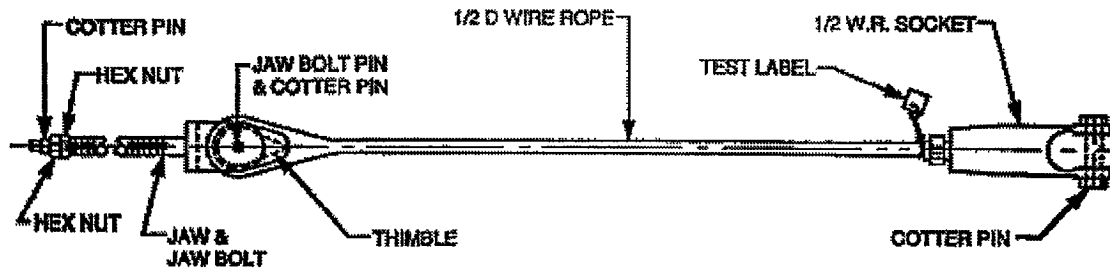


Figure 600-6.3. Cable Assembly Wire Rope

### 600-6.5 AUTOMATIC CATCH ASSEMBLY.

600-6.5.1 The automatic catch assembly is a safety device installed on all ballistic hatches. Various materials are used in the manufacture of automatic catch assemblies dependant upon the location of installation and end use. Catch bodies, catch pins, and guide pins of automatic catch assemblies located in weather area (except the barricade webbing hatch on CVs/CVNs) trunks leading to shaft alleys or JP-5 pump rooms are made of CRES material (Class 316 COD.A) in accordance with military specification (MIL-SPEC) QQ-S-763. The catch pin and guide pin for closures used in non-sparking areas shall be made of brass in accordance with MIL-SPEC QQ-B-637. The catch spring shall be made of phosphor bronze alloy 510, in accordance with MIL-SPEC QQ-W-321. Open ends of the coil spring are ground flush on both ends. See figure 600-6.4.

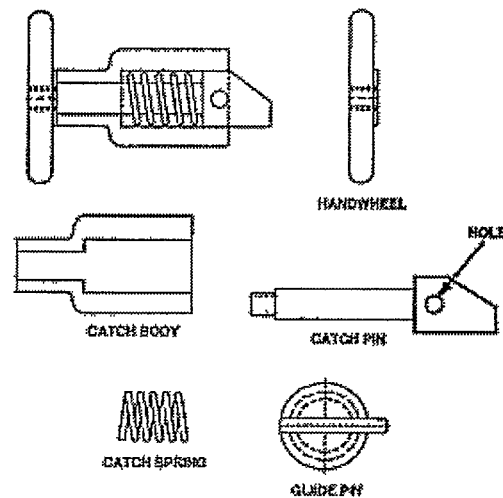


Figure 600-6.4. Automatic Catch Assembly

### 600-6.6 SPINDLES.

600-6.6.1 Dogging devices for a ballistic hatch may have either a cone spindle or a straight spindle. Cone spindles are supported by a cone bushing and a split bushing. Spindles are manufactured of steel alloy in accordance with MIL-N-3182 and machine threaded to receive the internal threaded portion of the dog selected for the

type and style hatch installed. Spindles are drilled and tapped during final assembly to receive a setscrew which retains the dog in proper position selected. The hexagon end of the straight spindle is drilled and tapped to receive a phosphor bronze packing plunger. Spindles for flush deck hatches are drilled and tapped at the threaded end to receive a phosphor bronze packing plunger and a 1/2-13NC dog retaining setscrew. See figure 600-6.5.

600-6.6.1.1 Requests for information on replacement of cone spindles should include the following:

- a) Width across the flats or parallel sides of hex head.
- b) Thickness of hex head.
- c) Spindle length (measured from under the hex head to the spindle).
- d) Outer diameter of the spindle bearing surface.
- e) Length of the spindle bearing surface.
- f) Whether the thread end of the spindle is drilled and tapped for a packing plunger.

600-6.6.1.2 Requests for information on replacement of straight spindles should include the following:

- a) Width across the flats or parallel sides of hex head.
- b) If round headed, the outer diameter.
- c) Thickness of the head.
- d) Spindle length (measured from under the spindle head to the end of the spindle).
- e) Outer diameter of the spindle bearing surface.
- f) Whether the thread end of the spindle is drilled and tapped for a packing plunger.

## **600-6.7 BUSHINGS.**

600-6.7.1 Ballistic hatches may require the use of a cone shaped bushing insert. The cone bushing is used in connection with a split bushing. The dimensions of the split bushing vary with the design of the hatch. It may be necessary to remove a dogging device in order to properly measure and identify the part. Due to the distinct difference and application of cone bushings, specific installation instructions should be followed. Instructions not available should be requested.

Nimitz class carriers use solid bushings 2-1/32-inch inside diameter instead of a split bushing. The lengths of solid bushings vary from 2-11/16 inch to 4 inches. In all correspondence concerning this type bushing, specify length and inside diameter, and indicate tapered or flush ends. Bushings are made of bronze material in accordance with applicable list of material (MIL-B-16443). See figure 600-6.5.

## **600-6.8 HATCH BEARING PLATE.**

600-6.8.1 Hatch bearing plates and the associated bearing washers differ in dimensions due to the design and size of the hatch. The use of spacers under the bearing plate may be required on some older ships. Bearing washers and bearing plates are made of brass material in accordance with applicable list of material (MIL-N-994). Bearing plates are held in place by 1/4-inch x 5/8-20NC(A) flat head brass machine screws in accordance with appli-

cable list of material (MIL-S-933). In all correspondence concerning hatch bearing plates, include as much of the following information as possible to assist in obtaining replacement parts:

- a) Size of the clear opening.
- b) Quick-acting or individually dogged.
- c) Hatch location (deck, frame number, and port or starboard).
- d) Thickness of spacers (if applicable).

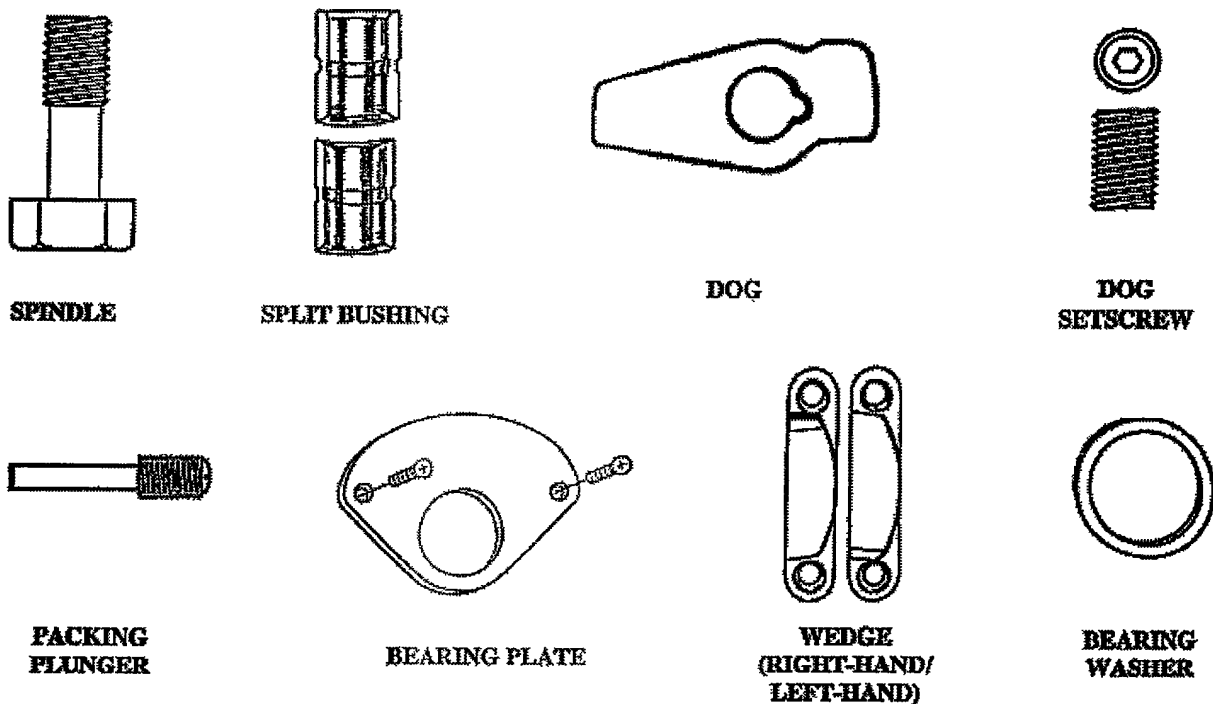


Figure 600-6.5. Spindle, Split Bushing, Dog and Dog Setscrew, Packing Plunger, Bearing Plate, Wedge (Right-Hand/Left-Hand), and Bearing Washer

### 600-6.9 PACKING PLUNGER.

600-6.9.1 Some ballistic hatches use a distinctly different packing plunger which is located in the hatch cover adjacent to the hex head spindle. This style packing plunger is inserted at an angle to the spindle. The outer end of the packing plunger is round headed with a screwdriver slot, and the shaft portion is partially threaded to allow insertion into the drilled and tapped hole in the hatch cover. If alemite zerk fittings are found installed in a hatch, the fittings are to be replaced with proper packing plungers if dog spindles penetrate through the hatch. A through spindle packed with general purpose grease will not maintain watertightness; therefore, alemite zerk fittings are permitted for use only in non-penetrating dog spindles. Packing plungers are normally made of phosphor bronze in accordance with the applicable list of material (MIL-SPEC QQ-P-330-COMPA). See figure [600-6.5](#).

## 600-6.10 TURNBUCKLE ASSEMBLIES.

600-6.10.1 Turnbuckle assemblies with connecting links are available for quick-acting ballistic armored hatches. The size of the hatch determines the length of the connecting rods and links. The installed turnbuckle assembly provides a means for adjusting the dogs to the proper positions. Right-hand and left-hand threads are machined at opposing ends of connecting rods. Likewise, turnbuckle fittings are machined to receive the right and left threaded portion of the connecting rod. Connecting rod locknuts are drilled and tapped with right-hand and left-hand threads. Connecting rod shoulder bolts are retained by hexagon shaped nuts drilled to receive retaining cotter pins. A connecting rod washer is installed on each connecting rod stud and shoulder bolt. See figure 600-6.6 and figure 600-6.7

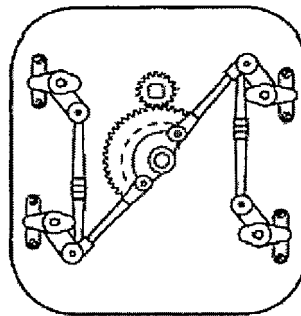


Figure 600-6.6 Turnbuckle Assembly

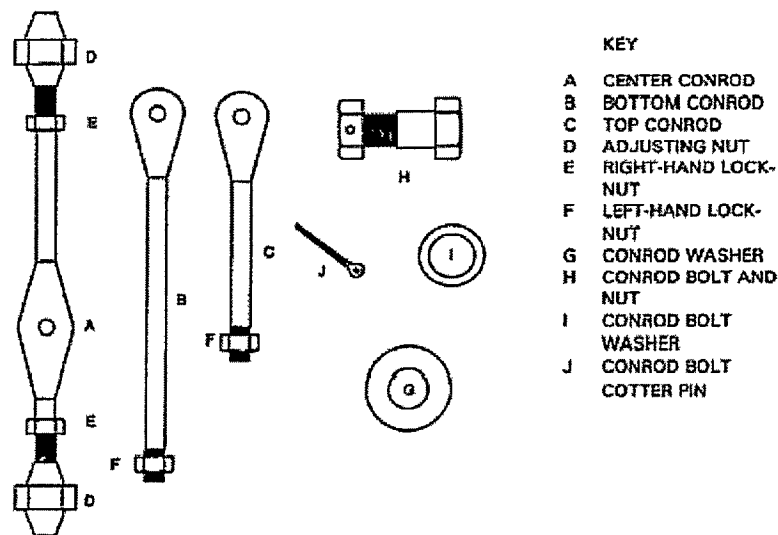


Figure 600-6.7. Turnbuckle Assembly Parts

## 600-6.11 BALLISTIC HATCH REPLACEMENT PARTS.

600-6.11.1 The variation in arrangement and design of quick-acting hatches makes it essential to provide specific information when requesting information or when attempting to procure parts. The following information should be provided in any correspondence concerning quick-acting ballistic hatches:

- a) Ship's hull number.
- b) NAVSEA/BUSHIPS Drawing number.
- c) Sample or photograph of parts.
- d) Hatch size (with the hatch open, measure the length and width between the inner edges of the deck plate).
- e) Quick-acting or individually dogged.
- f) If quick-acting, method of operation.
- g) Power operated, spring balanced, counterweighted, or hydraulic.
- h) Number of straight dogs and angle dogs.
- i) Hinged on short or long side of hatch.
- j) Approximate thickness of the deck.



**SECTION 7**  
**NON BALLISTIC SCUTTLES**

**600-7.1 SCUTTLES.**

600-7.1.1 Overview. A scuttle is defined as a small circular or oval opening fitted in decks or bulkheads to provide access. When used as escape scuttles and fitted with means whereby the covers can be opened quickly to permit exit, they are called quick-acting scuttles. The scuttles covered in this subsection include raised watertight, flush watertight, flush watertight and ramped low profile (2722 kg (6000lb.) wheel load), ballistic balanced armor.

600.7.1.2 Steel, Raised Watertight Scuttles (Figure 600-7.1). Raised watertight scuttles are built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE/#DOGS
BUSHIPS 803-1401890	18"/3 dog
BUSHIPS 803-1401891	21"/4 dog
BUSHIPS 803-1401892	21"/3 dog
BUSHIPS 803-162308	25"/4 dog

These scuttles are installed in hatches and decks in interior and exterior areas, and offset in a corner out of high traffic zones, where rapid access/egress is required. They may be used as an emergency egress or alternate access to berthing, machinery spaces or storerooms.

600-7.1.3 Steel, Flush Watertight Scuttles (Figure 600-7.2). Flush watertight scuttles are built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE/#DOGS
<b>BUSHIPS 803-1624054</b>	<b>18"/3 dog</b>
BUSHIPS 803-1624056	21"/3 dog
BUSHIPS 803-1624057	25"/4 dog
NAVSEA 803-5773913	25"/4 dog*

\*Spring Balanced

600-7.1.3.1 These scuttles are installed in flush hatches (where specified), and areas such as flight decks, cargo decks, hangar decks, passageways or areas of relatively high traffic where a flush deck condition is required to eliminate tripping hazards or to maintain a smooth trucking surface. Flush scuttles, 25" diameter, are also installed in bulkheads, where required, to provide emergency egress from a compartment. Trough drains are required for flush scuttles in weather decks. When flush scuttles are installed in areas subject to wheel loads from vehicle traffic, the scuttle shall be reinforced as necessary to withstand the applied wheel loads. For flush scuttles in areas subject to heavy wheel loads, see paragraph 600-7.1.4. Whenever possible, ramped low profile scuttles are preferred over flush scuttles in weather decks, as they eliminate the problem of corrosion and debris that usually accumulate in the trough area and recessed hinge pockets of flush scuttles. Ramped low profile scuttles also eliminate the need for trough drains in weather deck areas.

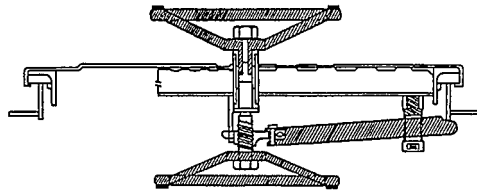
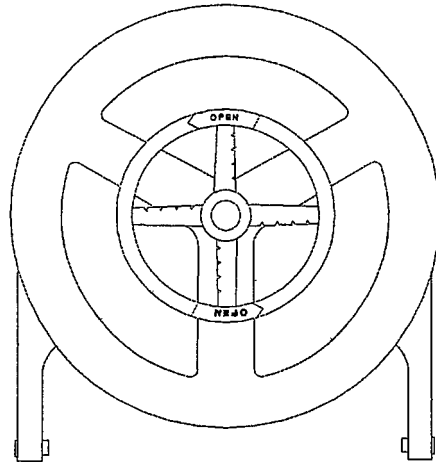


Figure 600-7.1. Raised Watertight Scuttle

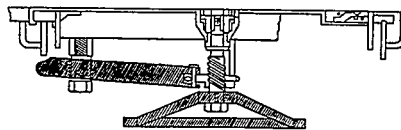
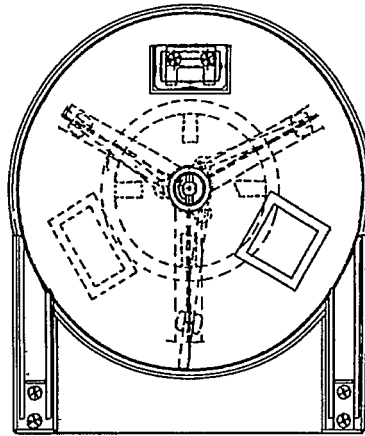


Figure 600-7.2. Flush Watertight Scuttle

600-7.1.4 Steel, Flush Watertight Scuttles (2722 Kg (6000 lb.) Wheel Load) and Ramped Low Profile Scuttles (2722 Kg (6000 lb.) Wheel Load) - (Figure 600-7.3 & Figure 600-7.4). Flush and ramped low profile scuttles are built in accordance with the following NAVSEA standard drawings:

DRAWING	SIZE/#DOGS
NAVSEA 803-5184144*	21"/3 dog
NAVSEA 803-5184145**	21"/3 dog

\*Ramped low profile, not spring balanced

\*\*Flush type, with drains, not spring balanced

600-7.1.4.1 These scuttle types are installed in areas such as flight decks, hangar decks, cargo decks, passage-ways, or areas of high traffic that may be subject to wheel loads of up to 2722 kg (6000 lb.) (max). Where wheel loads may exceed 2722 kg (6000 lb.), the scuttle assembly should be reinforced as necessary to withstand the applicable wheel loads. For exterior installations, flush scuttles are to be provided with trough drains. Ramped low profile scuttles are installed in areas where a minimum height ramped scuttle would not be detrimental to shipboard vehicular traffic or pose a tripping hazard. Whenever possible, ramped low profile scuttles are preferred over flush scuttles, as they eliminate the problem of corrosion and debris that usually accumulate in the trough area, and also eliminate the need for trough drains.

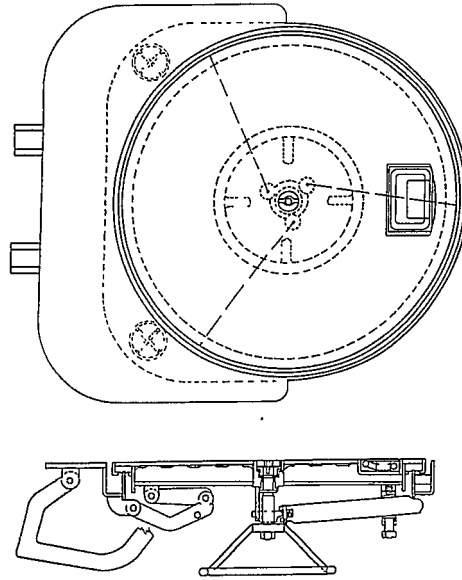


Figure 600-7.3. Flush Watertight Scuttle (2722 Kg (6000 Lb) Wheel Load)

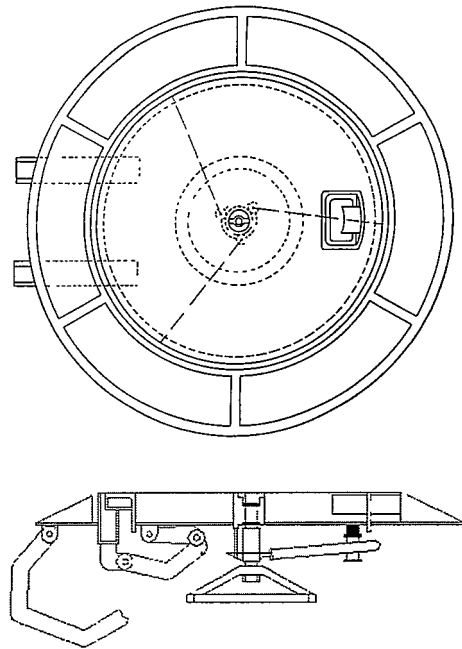


Figure 600-7.4. Ramped Low Profile Scuttle (2722 Kg (6000 Lb) Wheel Load)

## 600-7.2 SCUTTLE REMOVAL.

600-7.2.1 If routine maintenance is not sufficient to restore a watertight scuttle to watertight or operating condition, repair or replace defective parts. (Refer to Section 2 for inspection and maintenance procedures.) Refer to the Afloat Shopping Guide and to S9086-UF-STM-010 appendix B for information to help identify and procure replacement parts. If the answer to the problem is not covered in the appendices, consult the appropriate techni-

cal point of contact at Naval Surface Warfare Center, Carderock Division - Ship Systems Engineering Station (NSWCCD-SSES), or a commercial point of contact. To accomplish repairs on the handwheel assembly, the dog arms, or the hinges, remove the scuttle from its frame as follows:

- a) Use a chisel to knock off the upper brace link collar and hinge pin collars. Remove the hinge pins and brace link pin.
- b) For flush scuttles, remove the flathead screws from the hinge blocks.
- c) Lift the scuttle from its frame. Rope off the opening or cover with plywood as a safety precaution. Carry the scuttle to the shop for disassembly.

### **600-7.3 DISASSEMBLY AND REPAIR.**

600-7.3.1 Steel Scuttles. To disassemble the scuttle, use the follow procedures:

- a) To remove the handwheel(s), remove the handwheel locknut(s) from the ends of the spindle. (Jamnuts or a jamnut and acorn nut must be installed in place of a locknut.)
- b) Remove the cotter pin and clevis pin attaching each dog arm to the spider. Remove the dog arms from the assembly. See figure [600-7.5](#) and figure [600-7.6](#).
- c) For flush scuttles, remove the spindle collar setscrew and unscrew the collar. See figure [600-7.7](#).
- d) Unthread the spider from the spindle. Remove the spindle from the spindle sleeve.
- e) Using a 5/8-inch diameter (approximate) brass pipe or round stock, drive out the two flanged spindle bushings from the sleeve.
- f) Scrape rust, paint, and old grease from the spindle sleeve using a flat tipped punch and a 1-inch diameter rotary wire brush chucked in an electric drill. A no. 320 grit aluminum oxide cloth can also be used. Remove all traces of packing with a rag and dry cleaning solvent. Use caution when working with the flammable solvent.
- g) 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 by hand. If the bolt screws in all the way by hand, it is worn and must be replaced.

#### **CAUTION**

**The gasket must be removed from the scuttle before working with an oxy-acetylene torch; otherwise, the heat will destroy the gasket.**

- h) Remove the dog adjusting bolt from each dog rest. If a bolt is frozen to the dog rest, heat the dog rest with an oxyacetylene torch. Secure the torch, and remove the bolt with a wrench.

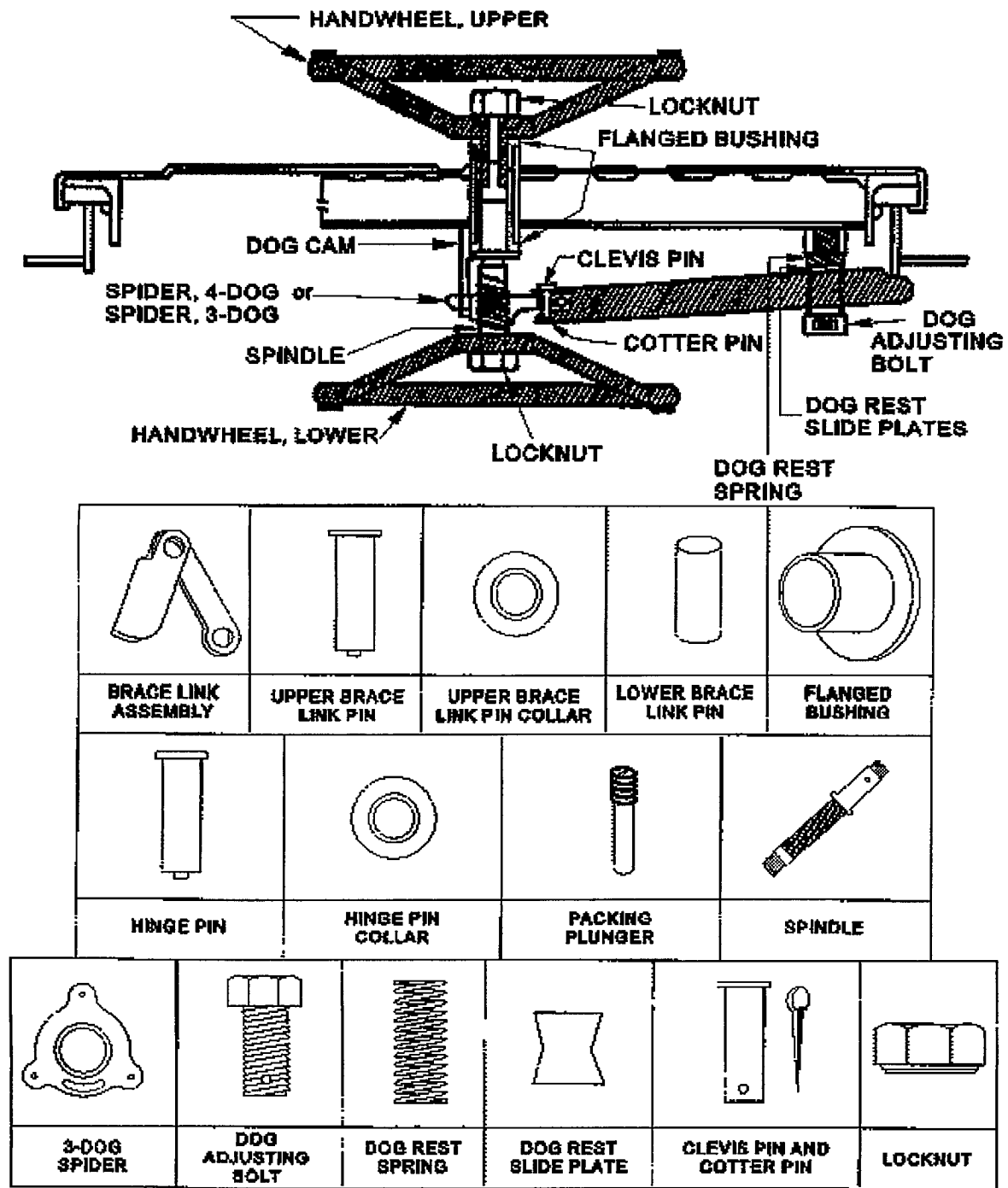


Figure 600-7.5. Raised Scuttle Components

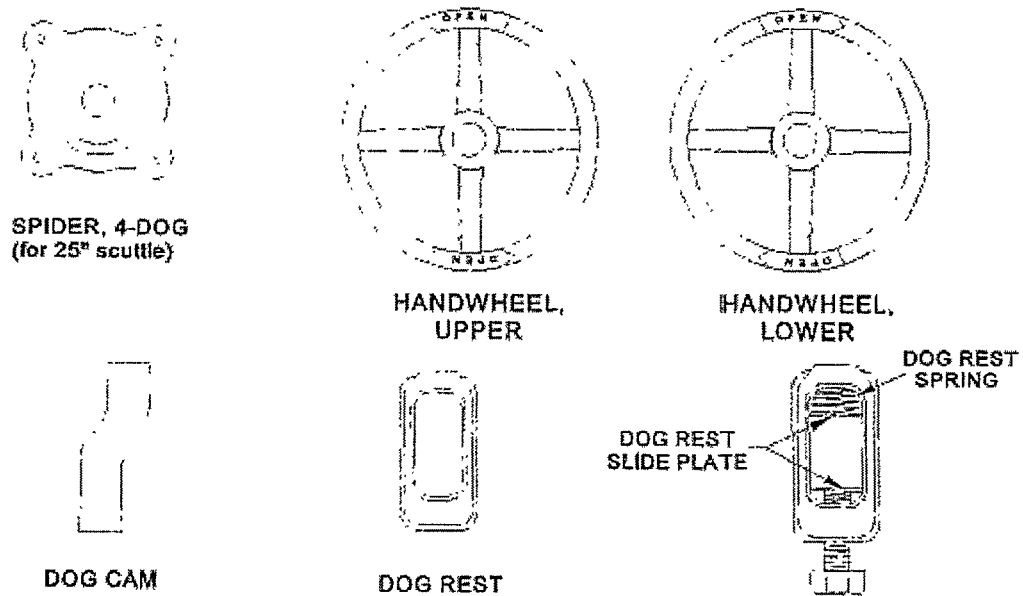


Figure 600-7.6. Scuttle Components

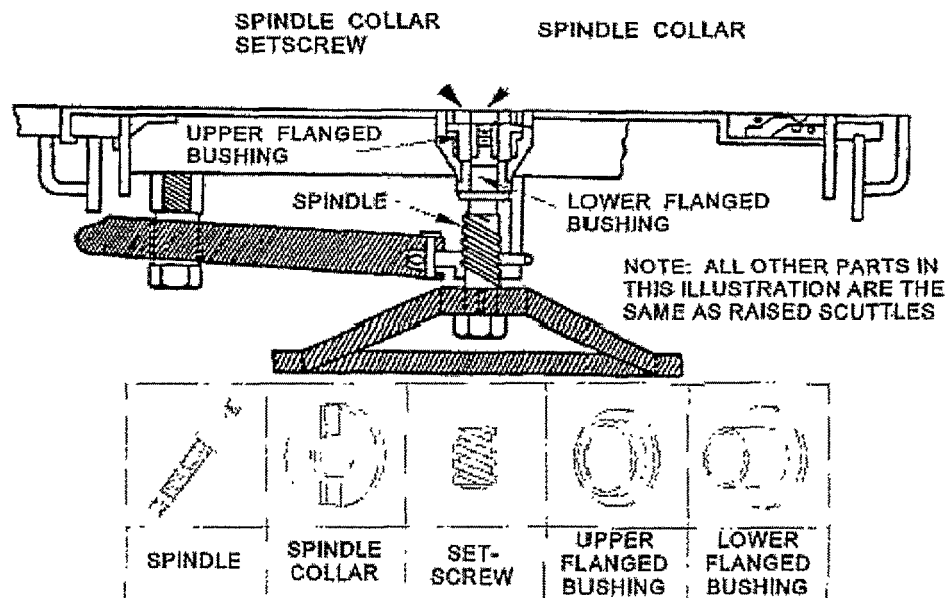


Figure 600-7.7. Flush Scuttle Components

- i) If the threads in a dog rest are damaged beyond repair, replace the dog rest as follows:
  - 1) Burn the dog rest off with an oxyacetylene torch.
  - 2) Weld on a new dog rest in exactly the same position and alignment as the dog rest removed.
- j) Chase the threads in each dog rest with a 5/8-18UNF tap.
- k) Coat the dog adjustment bolt threads with antiseize compound.

- l) Examine all other parts for wear or damage, and procure replacement parts as required. (Refer to the Afloat Shopping Guide). Chase spindle threads with a 3/4-16UNF tap and die. Replace the spindle if any of the following conditions are found:
- 1) Spindle is bent or has deep scratches.
  - 2) The threads are so badly worn that a new spider, when screwed on to the spindle, wobbles excessively.
  - 3) The machined flange is cracked or completely broken away. Often, the flange will crack around the entire periphery of the inner diameter, breaking free and forming what looks like a washer. See figure 600-7.8.

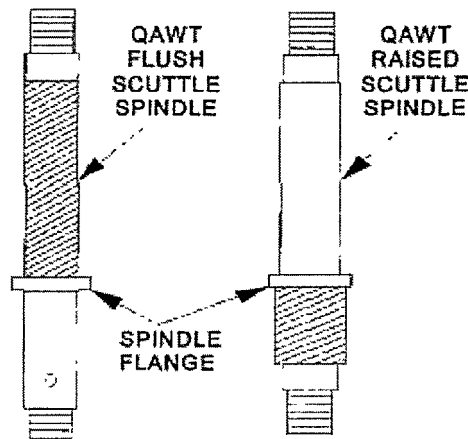
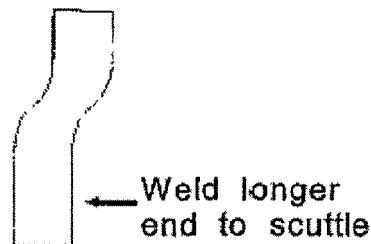


Figure 600-7.8. Scuttle Spindles

If either the spindle or the spider is damaged, replace both parts; otherwise, the spindle and spider will not fit properly. If the spider must be replaced, be aware that spiders for 18- and 21-inch scuttles have three dog arm holes and are interchangeable. Spiders for 25-inch scuttles have four dog arm holes and can only be used on 25-inch scuttles

- m) Examine the dog cam welded to the scuttle underside. See figure 600-7.5 and figure 600-7.6. Dog cams can become bent or break away completely over time from operation of the handwheels. If a cam requires replacing, it is important to position the new cam exactly in the same position as the old cam. Carefully mark the position of the old cam to indicate the proper fit-up of the new dog cam to the slot in the spider. If the old cam is missing, the old weld left on the scuttle will give a good idea of the proper position for the cam. Ensure the correct end of the cam is welded to the spider. The longer of the two sections of the cam is the end that should be welded. See figure 600-7.9.
- n. Clean parts with a rag and dry cleaning solvent. Prime and paint the dog arms. Use Formula 150 primer and Formula 151 top coat.



**DOG CAM**

Figure 600-7.9. Dog Cam



## 600-7.4 ALUMINUM SCUTTLES.

600-7.4.1 To disassemble the scuttle, use the follow procedures:

- a) To remove the handwheel(s), remove the handwheel locknut(s) from the ends of the spindle. (Jamnuts or a jamnut and acorn nut must be installed in place of a locknut.)
- b) remove the cotter pin and clevis pin that attach each dog arm to the spider.
- c) remove the dog arms from the assembly. See figure [600-7.5](#) and figure [600-7.6](#).
- d) For flush scuttles, remove the spindle collar setscrew and unscrew the collar. See figure [600-7.7](#).
- e) Unthread the spider from the spindle. Remove the spindle from the spindle sleeve.
- f) Using a 5/8-inch diameter (approximate) brass pipe or round stock, drive out the two flanged spindle bushings from the sleeve.
- g) Use a Scotch Brite pad to scrape corrosion, paint, and old grease from the spindle sleeve. Remove all traces of packing with a rag and dry cleaning solvent. Use caution when working with the flammable solvent.
- h) 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 dog-ging arm. Inspect each adjustment bolt for wear by trying to tighten by hand. If the bolt screws in all the way by hand, it is worn and must be replaced.

### CAUTION

#### **Do not apply heat to remove dog adjusting bolt.**

- i) Remove the dog adjusting bolt from each dog rest. If a bolt is frozen to the dog rest, use solvent to loosen the dog bolt.
- j) If the threads in a dog rest are damaged beyond repair, replace the dog rest as follows:
  - 1) Grind down the dog rest.
  - 2) Weld on a new dog rest in exactly the same position and alignment as the old one.
- k) Chase the threads in each dog rest with a 5/8-18UNF tap.
- l) Coat the dog adjustment bolt threads with antiseize compound.
- m) Examine all other parts for wear or damage, and procure replacement parts as required. (Refer to the Afloat Shopping Guide.) Chase spindle threads with a 3/4-16UNF tap and die. Replace the spindle if any of the following conditions are found:
  - 1) Spindle is bent or has deep scratches.
  - 2) The threads are so badly worn that a new spider, when screwed onto the spindle, wobbles excessively.
  - 3) The machined flange is cracked or completely broken away. Often, the flange will crack around the entire periphery of the inner diameter, breaking free and forming what looks like a washer. See figure [600-7.8](#). If either the spindle or the spider is damaged, replace both parts; otherwise, the spindle and spider will not fit properly. If the spider must be replaced, be aware that spiders for 18- and 21-inch scuttles have three dog arm holes and are interchangeable. Spiders for 25-inch scuttles have four dog arm holes and can only be used on 25-inch scuttles.
- n) Examine the dog cam welded to the scuttle underside. See figure [600-7.5](#) and figure [600-7.6](#) Dog cams can

become bent or break away completely over time from operation of the handwheels. If a cam requires replacing, it is important to position the new cam in exactly the same position as the old cam. Carefully mark the position of the old cam to indicate the proper fit-up of the new dog cam to the slot in the spider. If the old cam is missing, the old weld left on the scuttle will give a good idea of the proper position for the cam. Ensure the correct end of the cam is welded to the spider. The longer of the two sections of the cam is the end that should be welded. See figure [600-7.9](#).

- o) Clean parts with a rag and dry cleaning solvent. Prime and paint the dog arms. Use Formula 150 primer and Formula 151 top coat.

## **600-7.5. SCUTTLE ASSEMBLY.**

### 600-7.5.1 Handle Installation for Raised Scuttles.

#### 600-7.5.1.1 To install a handle:

- a) Thinly coat the inside of the spindle sleeve with a silicone compound.
- b) Coat the lower flanged bushing with a silicone compound, and tap into place in the sleeve with a rawhide hammer.

#### **NOTE**

For flush scuttles, the lower flanged bushing is shaped differently than the upper bushing. See figure [600-7.7](#).

- c) Coat the spindle bearing surface and thread with silicone compound, and thread the spider onto the spindle approximately halfway. The spider boss should face down, away from the spindle flange.
- d) Insert the spindle into the scuttle spindle sleeve. Pass the crescent shaped slot in the spider over the dog cam. There should be a loose fit between the cam and slot. If the fit is too tight, grind or file the slot to fit. The dog cam may need to be tapped to one side or the other with a hammer to help fit the slot in the spider over the dog cam. This is invariably true if the cam has been replaced.
- e) From the scuttle top, cut and wrap the spindle with approximately 12 inches of string packing. Push the packing into the spindle sleeve with a screwdriver. Coat the upper flanged bushing with silicone compound, and install the bushing.

#### **NOTE**

Do not apply string packing or stick packing if self-lubricated bushings are being installed in the assembly.

- f) Coat the spindle handwheel nut threads with antiseize compound, and install the upper handwheel.

#### **NOTE**

Be sure to install the upper handwheel. Ensure the arrow cast into the handwheel points in the direction the handwheel is turned to open the scuttle. On the lower handwheel, the arrow points in the opposite direction. Do not mix the directions up. See figure [600-7.6](#). Handwheels for 18- and 21-inch scuttles are 10 inches in diameter; handwheels for 25-inch scuttles are 13 inches in diameter.

- g) Install a 5/8-11UNC stainless steel locknut and tighten. If the nuts on the scuttle are plated steel, replace with CRES nuts. If in doubt, test with a magnet. The CRES nuts attract the magnet very little, if at all.
- h) If desired, add a stainless steel 5/8-11UNC acorn style cap nut atop the locknut to protect the packing plunger. Besides protecting the packing plunger, this method also eliminates any possibility of the handwheel nut loosening over time. The CRES acorn nuts are available through the Navy Stock System. If there are not enough threads left on the spindle to use the acorn nut, replace the previously installed CRES locknut with a CRES jamnut, which is thinner than the regular nut.

## **600-7.6 HANDLE INSTALLATION FOR FLUSH SCUTTLES.**

600-7.6.1 To install a handle:

- a) Thinly coat the inside of the spindle sleeve with a silicone compound.
- b) Coat the lower flanged bushing with a silicone compound, and tap into place in the sleeve with a rawhide hammer.

### **NOTE**

For flush scuttles, the lower flanged bushing is shaped differently than the upper bushing. See figure 600-7.7

- c) Coat the spindle bearing surface and thread with silicone compound, and thread the spider onto the spindle approximately halfway. The spider boss should face down, away from the spindle flange.
- d) Insert the spindle into the scuttle spindle sleeve.
- e) Coat the spindle collar threads with antiseize compound, and thread the collar onto the spindle until its top surface is flush with the top of the spindle.
- f) If either the spindle or spindle collar must be replaced, a new setscrew hole will have to be drilled and tapped. This is because new spindles and collars do not come drilled and tapped for a setscrew. Do not attempt to reuse the old hole in a reused part. Drill and tap a completely new hole. Use a no. 3 drill and 1/4-28UNF tap.
- g) Align the two halves of the setscrew hole in the collar and the spindle. Coat the setscrew with antiseize compound and install.

## **600-7.7 FINAL ASSEMBLY OF RAISED AND FLUSH SCUTTLES.**

600-7.7.1 To assemble a scuttle, following these procedures:

- a) For each dog arm, insert the dog rest spring and two dog rest slide plates into the dog rest. One slide plate sits on top of the spring and rides against the upper surface of the dog arm. The other slide plate rides against the lower side of the dog arm and rests on top of the end of the dog adjusting bolt.
- b) Insert the dog arm between the two slide plates, sliding the arm up and into the spider. Ensure the beveled side of the dog arm faces toward the scuttle underside or coaming.
- c) Pass the headed clevis pin from the scuttle underside through the hole in the dog arm and spider. Align the hole in the clevis pin with the small hole in the dog collar, and insert a 3/32-inch by 1-inch CRES or brass cotter pin. Bend over the long leg of the cotter pin.

- d) Repeat step a) through step c) for the other two or three dog arm assemblies.
- e) Coat the dog arm adjusting bolt threads with antiseize compound and install the bolts. Do not tighten the bolts at this time. Tighten the bolts only after assembly/adjustments and a chalk test are completed.
- f) For raised scuttles, install the lower handwheel, washer, and locknut. Use antiseize compound on the spindle threads.

## **600-7.8 INSTALLATION OF SCUTTLE ONTO FRAME.**

600-7.8.1 For installation of scuttles back onto the frame:

- a) Raised scuttles:
  - 1) Place the scuttle in the frame.
  - 2) Insert the hinge pins and lock collars. The beveled side of lock collars must face out.
  - 3) Install the brace link pin and collar. Bend the end of the pin with a ball peen hammer to lock the pin to the collar.
- b) Flush scuttles:
  - 1) Clean the recessed areas around the scuttle opening of any debris and corrosion. Prime and paint as required. Use Formula 150 primer and Formula 151 top coat.
  - 2) Replace the hinge pins, and peen over the boss with a backup hammer and ball peen hammer.
  - 3) Attach the brace link to the brace pad hinge block with a new pin. Peen over the boss to lock in place.
  - 4) Lay the hinge blocks over the screw holes in the scuttle recess. Place the scuttle in the frame over the hinge blocks, and replace the upper hinge plates and flathead screws. Coat the hinge blocks and brace link with wire rope grease.

### **NOTE**

The CRES brace links are available commercially for flush scuttles located on the weather decks.

- c) Standing below the scuttle, close and dog the scuttle approximately halfway. Set up on the dog adjusting bolts until the dog arms just begin to pull down on the scuttle.
- d) Open the scuttle and accomplish the chalk test. (Refer to Section 2, paragraph 600-2.3.2.5). Readjust dog bolts and accomplish another chalk test as required.
- e) Insert the packing plunger and stick packing. (Refer to Section 2, paragraph 600-2.4.2.3.1).

### **NOTE**

Scuttles equipped with self-lubricated bushings do not require stick packing or string packing. The packing plunger is left in place to fill the void that would remain in the spindle.

- f) Operate the scuttle to inspect for smoothness with a minimum of effort and no binding. The dog arms should fully engage the coaming. If the handwheel is difficult to turn, open the scuttle and tap the sides of the handwheels with a rawhide hammer from all four compass points. This procedure helps seat the bushings in proper alignment with the spindle. The handwheel should then be much easier to turn.

## SECTION 8

### BALLISTIC SCUTTLES

#### 600-8.1 OVERVIEW

600-8.1.1 Quick-acting balanced armor scuttles are of the same thickness and material as the plating in which they are installed. The edges of the scuttle and the plating have matching 45-degree bevels. In multiple course decks, the scuttles are of the same material as the upper course and in one thickness equal to the total thickness of the deck. Scuttles 18 inches in diameter have three dogs. Scuttles 25 inches in diameter have four dogs. The 18-inch balanced armor scuttle is used for normal quick access or egress through a closed (dogged position) balanced armor hatch, or for emergency use in a deck. The 25-inch balanced armor scuttle is used for an emergency access or egress from designated areas such as machinery spaces or rooms. In escape trunks passing through more than one deck, escape scuttles are usually stacked.

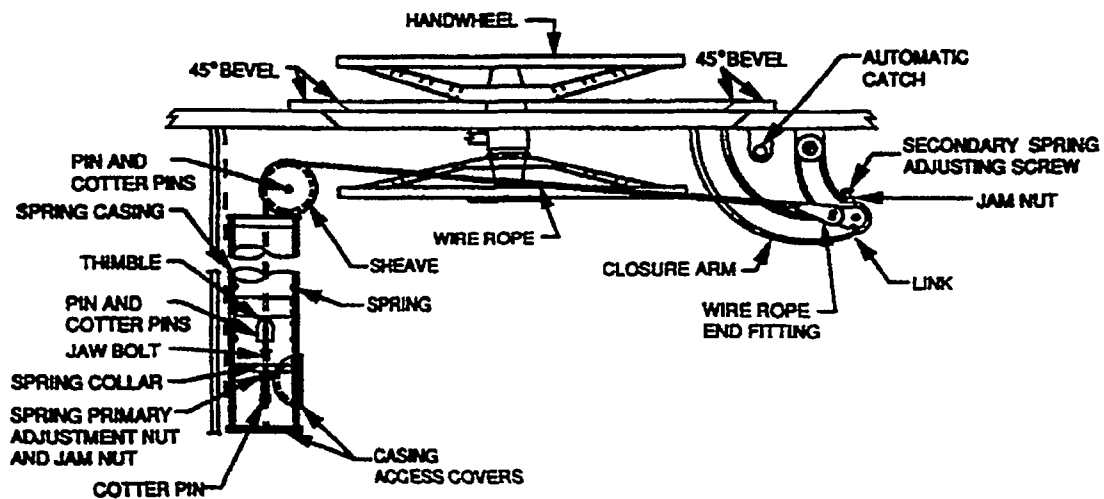


Figure 600-8.1. Typical Scuttle

600-8.1.2 Scuttles installed in hatches are designed to withstand the same design pressure as the hatch in which they are installed. Some scuttles may have insert plates which are reinforced by brackets or headers to maintain structural continuity with the deck and to minimize stress concentrations. Flush deck exterior scuttles have interior hinges, troughs, and 2-inch trough drains. Some ballistic scuttle designs use an individual dog mechanism with straight or angle dogs. This design is found on the flight deck scuttles of aircraft carriers. See figure 600-8.2.

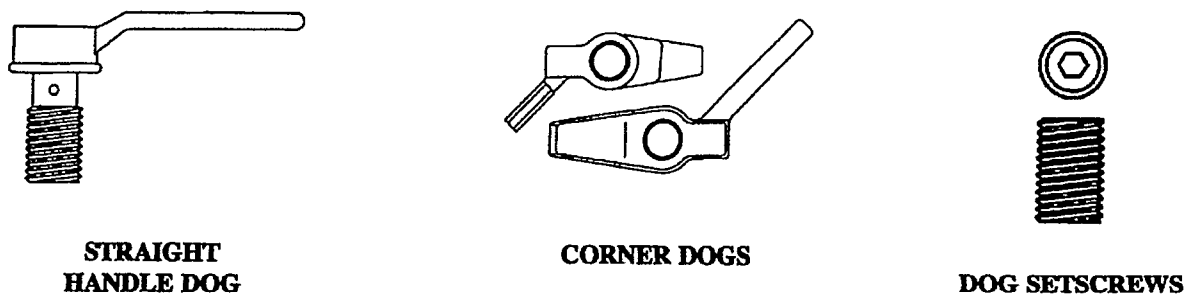


Figure 600-8.2. Straight Handle Dog, Corner Dogs, and Dog Setscrew

600-8.1.3 Other ballistic armor scuttles are balanced quick-acting. This type scuttle has either an 18-inch or 25-inch diameter clear opening and is operated by a quadrant gear dogging device. The 18-inch ballistic armor scuttle has a manganese bronze pinion gear that mates with three quadrant gears/dogs. See figure 600-8.3.

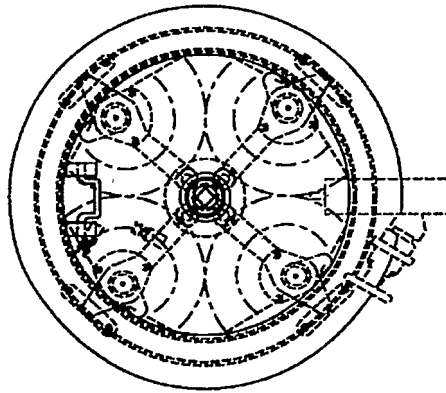


Figure 600-8.3. Ballistic Scuttle

600-8.1.4 The 25-inch ballistic armor scuttle is designed with a manganese bronze pinion gear which mates with four manganese bronze idler gears that in turn mate with four quadrant gears/dogs. See figure 600-8.4. The idler gear used on 25-inch ballistic armor scuttles is designed to mesh with the pinion gear. The pinion gear is designed to mesh with either the idler gear or with the quadrant gears/dogs, depending on the scuttle design. The pinion gear attached to the spindle shaft is actuated from above by use of T-slot wrench or a handwheel wrench. These special wrenches are normally stowed in brackets located near the closure. The closure is operated from below by a handwheel attached to the spindle shaft.

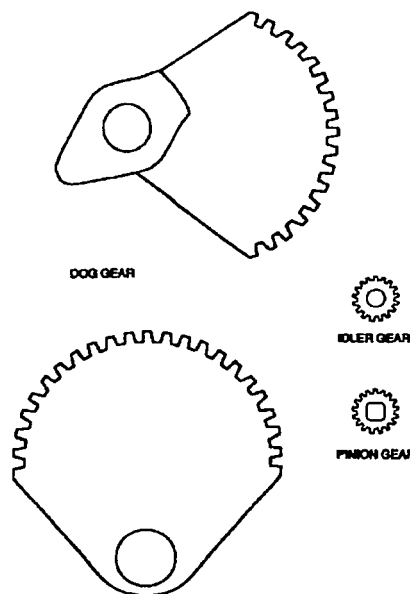


Figure 600-8.4. Scuttle Gears

600-8.1.5 Handwheel and handwheel wrenches are available in mild steel, cast steel, and bronze. Bronze handwheels are designated as non-sparking. This type handwheel is used in weapons areas, in pump room accesses, or in any location where a potentially explosive atmosphere exists. See figure 600-8.5.

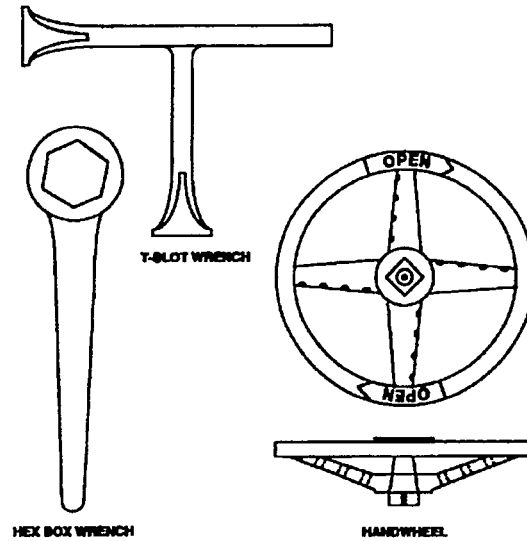


Figure 600-8.5 Handwheels and Wrenches

600-8.1.6 Ballistic armor balanced scuttle balancing assemblies use basically the same components as ballistic armor balanced hatches (for example, spring assemblies, spring casing and components, sheave assemblies, jaw bolt assemblies, secondary adjustment components, automatic catch assemblies, wire rope and associated parts). In any correspondence concerning ballistic armor scuttles, the following information should be provided. (See figure 600-8.1.)

- a) Ship's hull number.
- b) NAVSEA/BUSHIPS Drawing number.
- c) Sample or photograph of parts.
- d) Location of the scuttle (deck, frame number, and port or starboard).
- e) Scuttle size (with the scuttle open, measure the diameter from the inner edge of the hatch cover deck plate).
- f) Number of dogs.
- g) Approximate thickness of hatch cover deck plate.
- h) Type of dog (quadrant or individual).
- i) Rating (psi) of the hatch cover or deck, if available.
- j) Length of spindle (measure from under the spindle head to the end of the spindle).
- k) Length of the bearing surface.
- l) Outer diameter of bearing surface.
- m) Bushing length.
- n) Thickness of scuttle cover.
- o) Rating (psi) of scuttle, if available.
- p) Outer diameter of the scuttle.

## 600-8.2 SAFETY CATCH, CATCH BRACKETS, AND CATCH PINS.

600-8.2.1 Safety catch assemblies are vitally important for the safe operation of ballistic closures. The safety catch provides a secondary means of holding the closure in the open position.

Catch assemblies are available in galvanized steel and brass. Brass catch assemblies are intended for use in locations such as weapons area, pump rooms, or any potentially explosive atmosphere. The associated catch rods are available in galvanized steel (Grade M, MIL-S-20166). See figure 600-8.6.

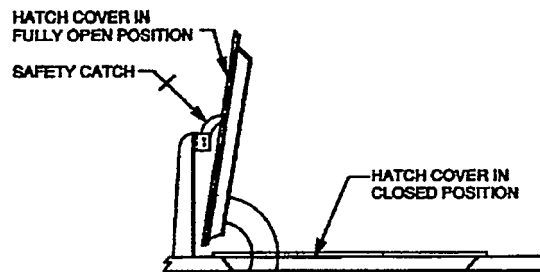


Figure 600-8.6. Safety Catch

## 600-8.3 TOOLS.

600-8.3.1 Due to the importance of special tools, relevant information is also included in this paragraph as follows:

- a) Hex box wrenches are available in mild steel and bronze. Bronze wrenches are designated as non-sparking and are manufactured in accordance with MIL-B-16443. These wrenches are used in weapons areas, pump room accesses, or any potentially explosive atmosphere. Mild steel galvanized wrenches are made in accordance with MIL-S-16974, Grade 1023-W.
- b) Handwheel wrenches are available in galvanized mild steel (MIL-SPEC ASTI-A-53 GR.B MIL-S-20166); bronze, Class "B" (MIL-B-16443); and cast steel (MIL-S-21066). The T-slot wrench (MIL-S-21066) is galvanized.

## 600-8.4 REPLACEMENT PARTS FOR BALLISTIC CLOSURES.

600-8.4.1 Various vendors can quote the prices and availability of complete quick-acting 3-dog and individually dogged 8-dog ballistic doors, individually dogged ballistic hatches (with or without scuttle), and ballistic scuttles, as well as all associated parts. Inquiries and/or requests for quotes should be accompanied by NAVSEA or BUSHIPS drawing number(s), the ship's hull number, or a sample of the component or part, if possible, to assist in identification

600-8.4.2 Ballistic (Armor) Scuttle. To obtain parts for a scuttle, be sure to know the following:

- a) Scuttle size (measured as diameter between inner edge of deck plate or hatch cover with scuttle open).
- b) Number of dogs.
- c) Approximate thickness of deck plate or hatch cover.



- d) Type of dog quadrant gear or individual dog.
- e) Measurement of the scuttle spindle socket (normally 7/8-inch square) should be furnished. (Refer to paragraph 600-8.3)
- f) Measurement of the hex head (across the flats) of the spindle should be furnished. (Refer to paragraph 600-8.3)

600-8.4.3.1 Automatic Catch Assembly. The automatic catch assembly is a safety device installed on all ballistic hatches and scuttles. Complete assemblies include the catch body, plunger, spring, and handwheel. Plungers are available in mild steel, corrosion resistant steel, or bronze. Corrosion resistant steel is to be used in weather deck, flight deck areas, or saltwater environments. Bronze plungers are designated non-sparking and are used in locations such as weapons areas, pump room accesses, or a normally potential explosive atmosphere. Handwheels shall be drilled and tapped for an Allen head setscrew to be used as a wheel-to-shaft locking device. This feature is designed to prevent the inadvertent rotation of the handwheel. Left-hand rotation of the handwheel will cause the loss of proper spring tension and the eventual failure of the catch assembly guide pin.

#### NOTE

**When requesting automatic catch assemblies, the location of the guide pin (left-or right-handed) must be specified, unless the installing activity intends to complete the assembly by properly installing the guide pin as required.**

## SECTION 9

### MANHOLE COVERS, BALLISTIC & NON-BALLISTIC

#### 600-9.1 PURPOSE & BACKGROUND

Manholes are openings into unmanned spaces, usually tanks and voids for the purpose of inspection and maintenance.

#### 600-9.2 DESCRIPTION

Manholes are fitted with covers that are designed to maintain watertight integrity and security from hazardous fluid encroachment. Manholes range in size and shape of the clear opening from 18-inch circular diameter to 15-inch by 23-inch ovals. A manhole that is installed in other than a horizontal structure, and with a cover that weighs 20 pounds, must have a hinge at the top. See Figure 600-9.1 In locations where potential contact with fuel or other petroleum products, the gaskets shall be in accordance with MIL-R-15624, Class 3.

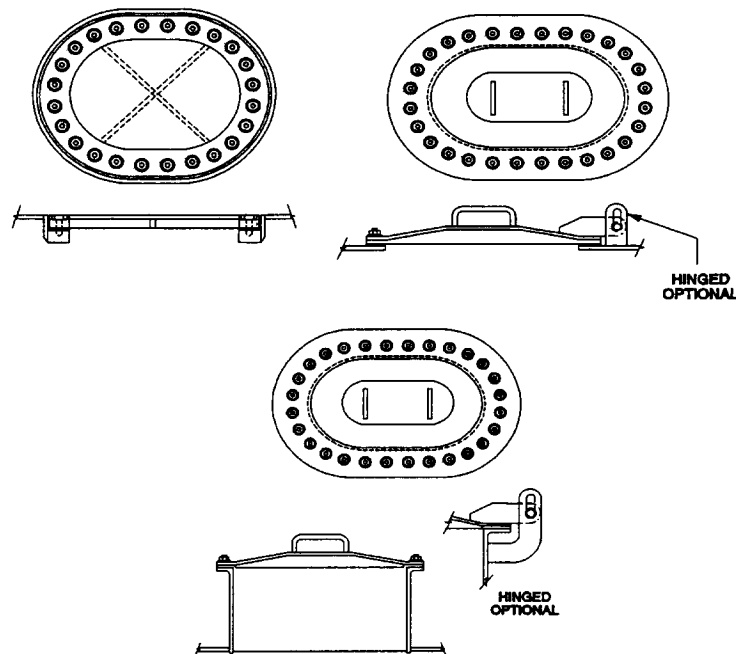


Figure 600-9.1 Watertight Manhole Cover

**600-9.2.1 RAISED MANHOLE COVER** Raised Manhole covers are to prevent inadvertent shipping of water into the space.

**600-9.2.2 FLUSH MANHOLE COVER** Flush-deck manholes are used in ammunition storage areas and in walking, working and operating areas where a raised manhole would be hazardous to personnel.

### 600-9.3 INSPECTION

**Manholes are fitted with covers that are designed to maintain watertight integrity and security from hazardous fluid encroachment. Manholes range in size and shape of the clear opening from 18-inch circular diameter to 15-inch by 23-inch ovals. A manhole that is installed in other than a horizontal structure, and with a cover that weighs 20 pounds, must have a hinge at the top.**

#### 600-9.3.1 RAISED & FLUSH MANHOLE COVERS

600-9.3.1.1 GENERAL INSPECTION PROCEDURE The following principles apply to inspections of all manholes.

- 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 the openings.
- e. Loose, missing, or damaged parts and parts showing excessive wear must be replaced.
- f. Manholes 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.
  3. Binding and difficult operations.
  4. Distortion and deterioration of metal surfaces.
  5. Hinge pin wear and pins (as necessary) 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, and gaps due to shrinkage where gasket ends meet.
  8. Obstructed access to Manholes.

#### 600-9.3.2 GASKET INSPECTION

600-9.3.2.1 Gaskets for manhole covers shall be in accordance with MILSPEC, MIL-G-1149, Class 2 for fresh water service, and MIL-C-6183 for all other services, including oil, gasoline, and seawater. Gasket material for manholes to spaces containing hydraulic equipment having phosphate ester based hydraulic fluid, shall be in accordance with MIL-R-83248.

- a. Open the Manhole and inspect the mating surface for paint, dirt, rust, nicks or damage or distortion. 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.

- b. Repair a nicked, damaged or distorted mating surface by building up the area with CRES stainless electrode and filing with a flat file. (The use of power grinders on mating surface is not recommended) Straighten bent knife-edge by reshaping with a hammer or by bending.

#### 600-9.3.2.1 Perform Chalk Test

600-9.3.2.1.1. The Chalk Test is a simple means of determining if the gasket is in continuous contact with the knife-edge when a scuttle is dogged. A successful chalk test does not guarantee that a scuttle 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 the scuttle, perform the following steps.

- a. Wipe the mating surface clean with a dry rag.
- b. Rub chalk on mating surface.
- a. Close and dog the manhole tightly.
- b. Open the manhole 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 imprint is not continuous, the closure is not watertight and requires further adjustment or repair

**APPENDIX A.****TECHNICAL MANUAL DEFICIENCY/EVALUATION REPORT(TMDER)****NOTE**

Ships, training activities, supply points, depots, Naval Shipyards, and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be reported to the Commander, NAVSURFWARCENDIV, 4363 Missile Way, Port Hueneme, CA 93043-4307 in NAVSEA/SPAWAR Technical Manual Deficiency/Evaluation Report (TMDER), NAVSEA Form 4160/1. To facilitate such reporting, print, complete, and mail NAVSEA Form 4160/1 below or submit TMDERS at web site <http://nsdsa.phdnswc.navy.mil/tmder/tmder.htm>. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting therefrom.

**TMDER / MAILER**

