

CHAPTER 3

DOOR REPAIR AND REPLACEMENT

3-1. STEEL DOORS.

3-1.1 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. (Refer to [chapter 2](#) for inspection and maintenance procedures.) If the answer to the problem is not covered in [chapter 3](#) 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.

3-1.2 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 3-1](#), and refer to [paragraph 3-1.6](#) and [paragraph 3-1.7](#), 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 3-1.8](#) for instructions.

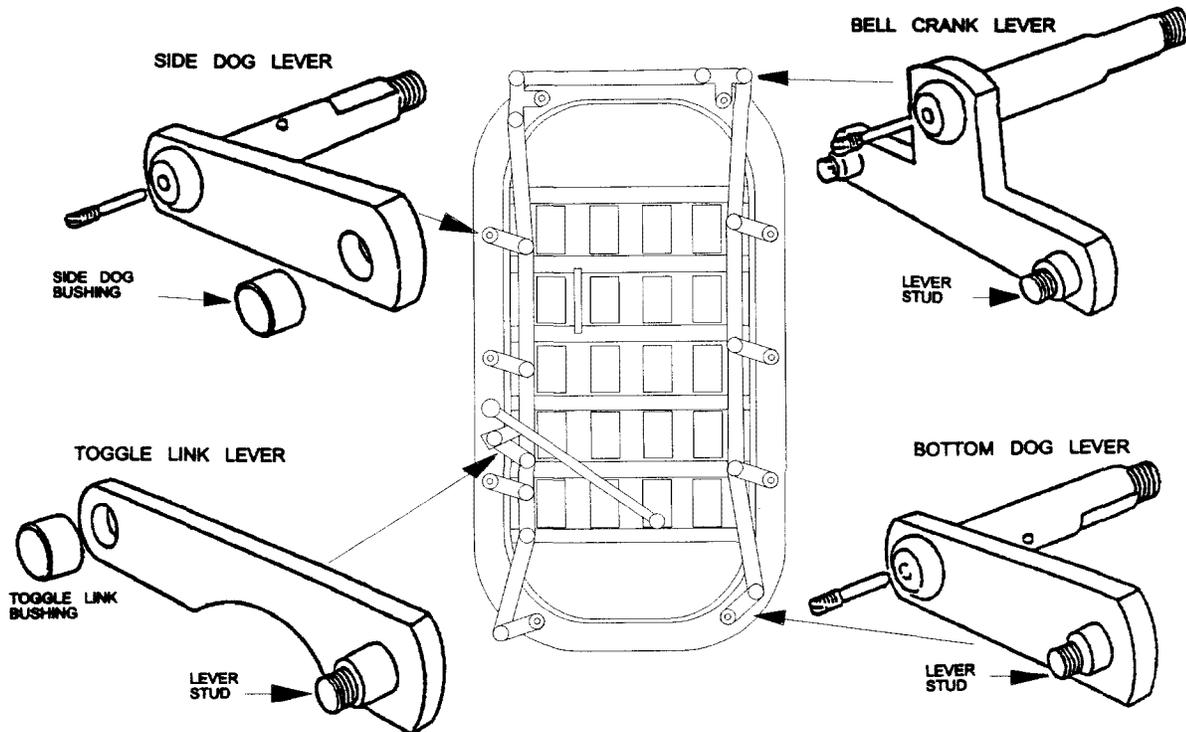


Figure 3-1. Quick Acting Door Levers

- 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.

3-1.3 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 (refer to [appendix C](#)), but are not available through the Navy Supply System. For installation of self-lubricated bushings, refer to [paragraph 3-1.4](#) or [paragraph 3-1.5](#). 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.

3-1.4 SELF-LUBRICATED BUSHING INSTALLATION. 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. (Ordering information for the bushing kits is provided in [appendix C, section I.](#))

- a. Remove the existing dog assembly and dog point setscrew. (Refer to [paragraph 3-1.7](#) for quick-acting dog disassembly or [paragraph 3-1.8](#) 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 3-1.7](#) for quick-acting dog installation or [paragraph 3-1.8](#) 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 [chapter 2, paragraph 2-1.9](#), for watertight door dog adjustments and to [chapter 2, paragraph 2-1.5](#), 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.

3-1.5 SINTERED BRONZE BUSHINGS WITH ELISHA TECHNOLOGIES EDC 1270 EPL GREASE AND CRES PAINT SHIELD.

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).

3-1.5.1 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 3-1A](#).

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 sliding onto the spindle with normal hand pressure. Then, remove flanged bushing.

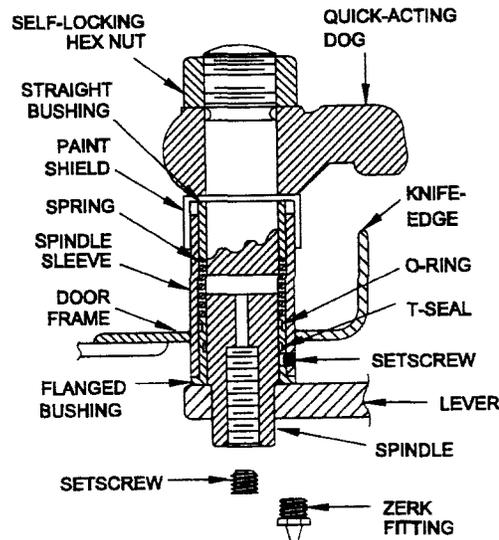


Figure 3-1A. Quick-Acting Door Dog Assembly (Cross Section View) Modified by MACHALT 167-31010 (ECP-526)

- 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 3-1.6](#). Adjust dogs in accordance with [chapter 2, paragraph 2-1.9](#), and chalk test in accordance with [chapter 2, paragraph 2-1.5](#).
- n. After adjustments and a chalk test are completed, lubricate dog and handle bushings in accordance with [chapter 2, paragraph 2-1.14](#).

3-1.6 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.

3-1.6.1 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 3-2](#).

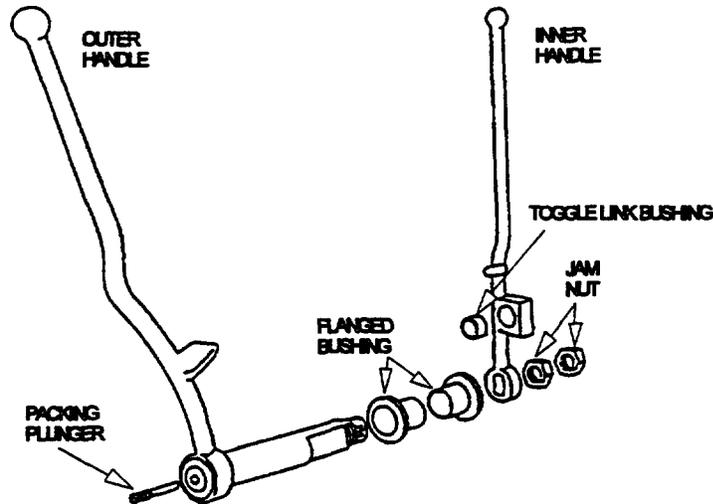


Figure 3-2. Quick-Acting Operating Handle Assembly (Left-Hand Shown)

3-1.6.2 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 3-3](#). 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.

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.

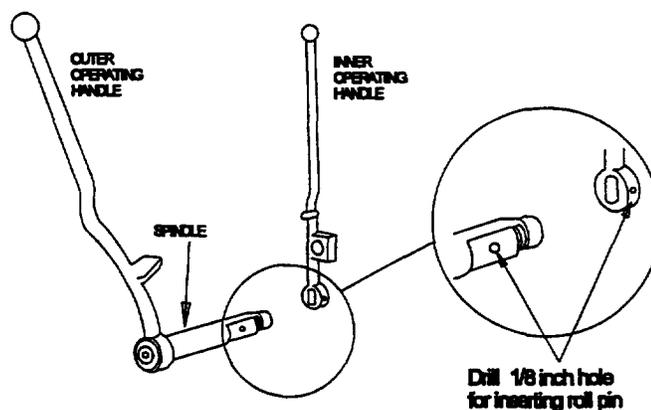


Figure 3-3. Quick-Acting Operating Handle Temporary Repair

NOTE

For exterior or well deck doors having MACHALT 167-31010 (ECP-526) installed, proceed to [paragraph 3-1.6.3](#).

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

Caution - precedes

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. NOTE Omit this step if installing self-lubricated bushings.
- 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 [chapter 2, paragraph 2-1.9](#), for watertight door dog adjustments and to [chapter 2, paragraph 2-1.5](#), 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.)

3-1.6.3 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.

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.

- c. 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.
- d. Apply a thin coat of EDC 1270 EPL grease to the exterior and face surface of both flanged bushings, and slide one into each of the spindle sleeves with normal hand pressure. Align the flanged bushings with the setscrew holes on the spindle sleeves. Leave flanged bushings in spindle sleeves. Install the setscrews, one turn only, into the spindle sleeve holes.
- e. Apply EDC 2400 caulk to setscrews installed in [step d](#). Tighten setscrews to near flush with the surface of the spindle sleeve or until tightness is achieved, then back off one-half turn.
- f. 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.

- g. 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.
- h. Install the inner handle, and engage in the spring clip assembly.
- i. Install toggle link lever to inner handle.
- j. Install the conrod collar over toggle link lever stud. Do not tighten.
- k. Install self-locking hex nut, and tighten just enough to eliminate play.
- l. 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.
- 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 [chapter 2, paragraph 2-1.9](#).
- p. Accomplish chalk test procedure in accordance with [chapter 2, paragraph 2-1.5](#).

3-1.7 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:

3-1.7.1 Conrod Disassembly.

- a. Remove the cotter pin, conrod collar (round nut), conrod, and washer from each conrod linkage. See [figure 3-1](#), [figure 3-4](#), and [figure 3-4A](#).
- b. Remove the conrods from the lever assemblies. For easier reassembly, mark each conrod and its location with a metal etcher.

3-1.7.2 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.

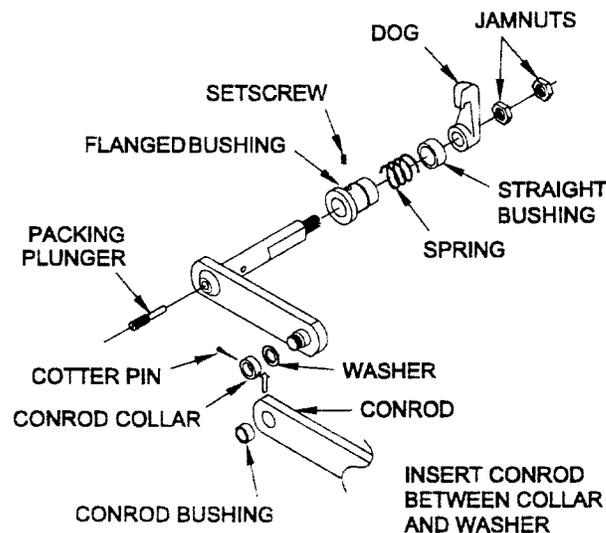


Figure 3-4. Quick-Acting Door Lever Assembly

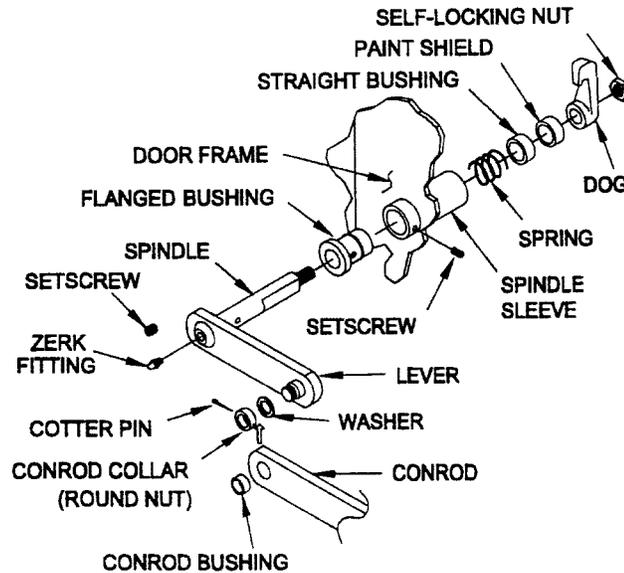


Figure 3-4A. Quick-Acting Door Lever Assembly Modified by MACHALT 167-31010 (ECP-526)

3-1.7.3 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 3-5](#). 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.
- 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.

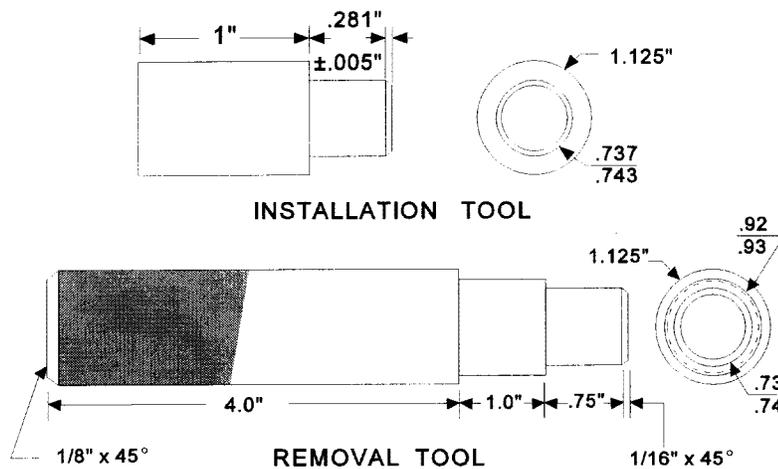


Figure 3-5. Conrod Removal and Installation Tool

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 [chapter 2, paragraph 2-1.6.3.](#)) 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 3-5](#). Using this tool along with the vise helps hold the bushing in proper alignment with the conrod while the bushing is pressed into place.

3-1.7.4 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 3-1.7.3](#) 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

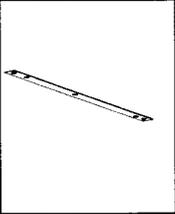
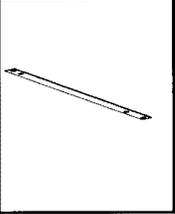
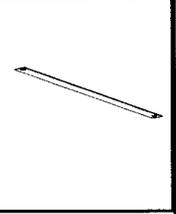
Do not sand and paint parts that are made of CRES. An easy way to differentiate between plated steel and CRES is with a magnet. Plated steel will attract the magnet; stainless steel will not.

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

3-1.7.5 Lever Installation. Prepare spindle sleeves and assemble bushing in each sleeve, as described in [paragraph 3-1.3](#) through [paragraph 3-1.5](#).

3-1.7.6 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 3-1.7.1](#) to locate the correct position for each conrod. Also see [figure 3-6](#). Insert one washer on each stud between the conrod and lever components at each linkage connection.
- 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.

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

NOTE: Matched letters indicate that these parts are interchangeable.

Figure 3-6. Conrod Location Guide

3-1.8 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.

3-1.8.1 Individual Dog Disassembly and Repair.

- 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 3-7](#) and [figure 3-7A](#).
- Remove the straight bushing and compression spring from the spindle sleeve.
- 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.

- 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.
- 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.

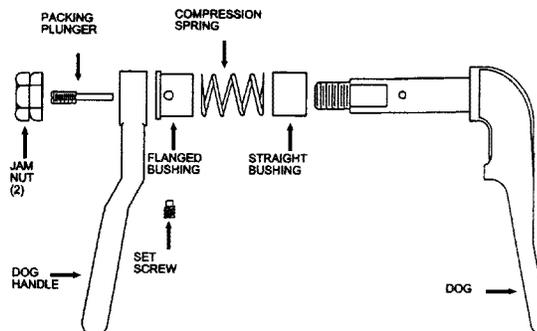


Figure 3-7. Individual Dog Assembly

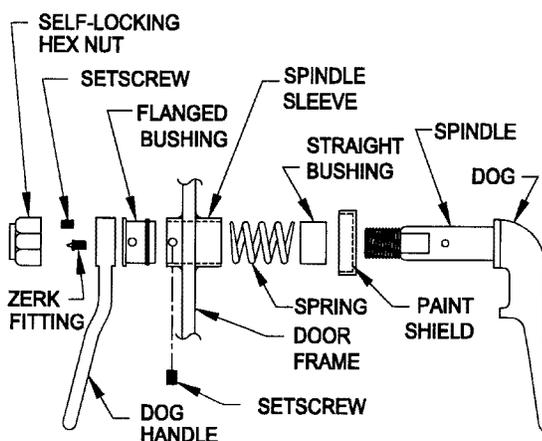


Figure 3-7A. Individual Dog Assembly Modified by MACHALT 167-31010 (ECO-526)

- f. Inspect all wear parts for excessive wear, and obtain replacement parts as required. Refer to [paragraph 3-1.3](#) and [paragraph 3-1.4](#) 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.

3-1.8.2 Individual Dog Installation.

NOTE

For repair/installation of individual dogs having MACHALT 167-31010 (ECP-526) installed, proceed to [paragraph 3-1.8.3](#). 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 [chapter 2, paragraph 2-1.9](#), for watertight door dog adjustments and to [chapter 2, paragraph 2-1.5](#), for procedures on accomplishing a chalk test.
- i. After adjustments and a chalk test are completed, install the second jamnut (if jamnuts are being used). 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. A few taps on the second wrench with a rawhide hammer should lock the two nuts together to prevent loosening.

3-1.8.3 Individual Dog Installation - Sintered Bronze Bushings with Elisha Technologies EDC 1270 EPL Grease and CRES Paint Shield. (See [figure 3-7A](#).)

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.

- 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 (6). 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. 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. When all dog assemblies are completed, install handle assembly in accordance with [paragraph 3-1.6](#). Adjust dogs in accordance with [chapter 2, paragraph 2-1.9](#), and chalk test in accordance with [chapter 2, paragraph 2-1.5](#).

- m. After adjustments and a chalk test are completed, lubricate dog and handle bushings in accordance with [chapter 2, paragraph 2-1.14](#).

3-1.9 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 [chapter 2, paragraph 2-1.6](#), 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 2-1.1](#), before starting repair work to door hinges.

3-1.9.1 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 3-8](#).
- 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 3-8](#).

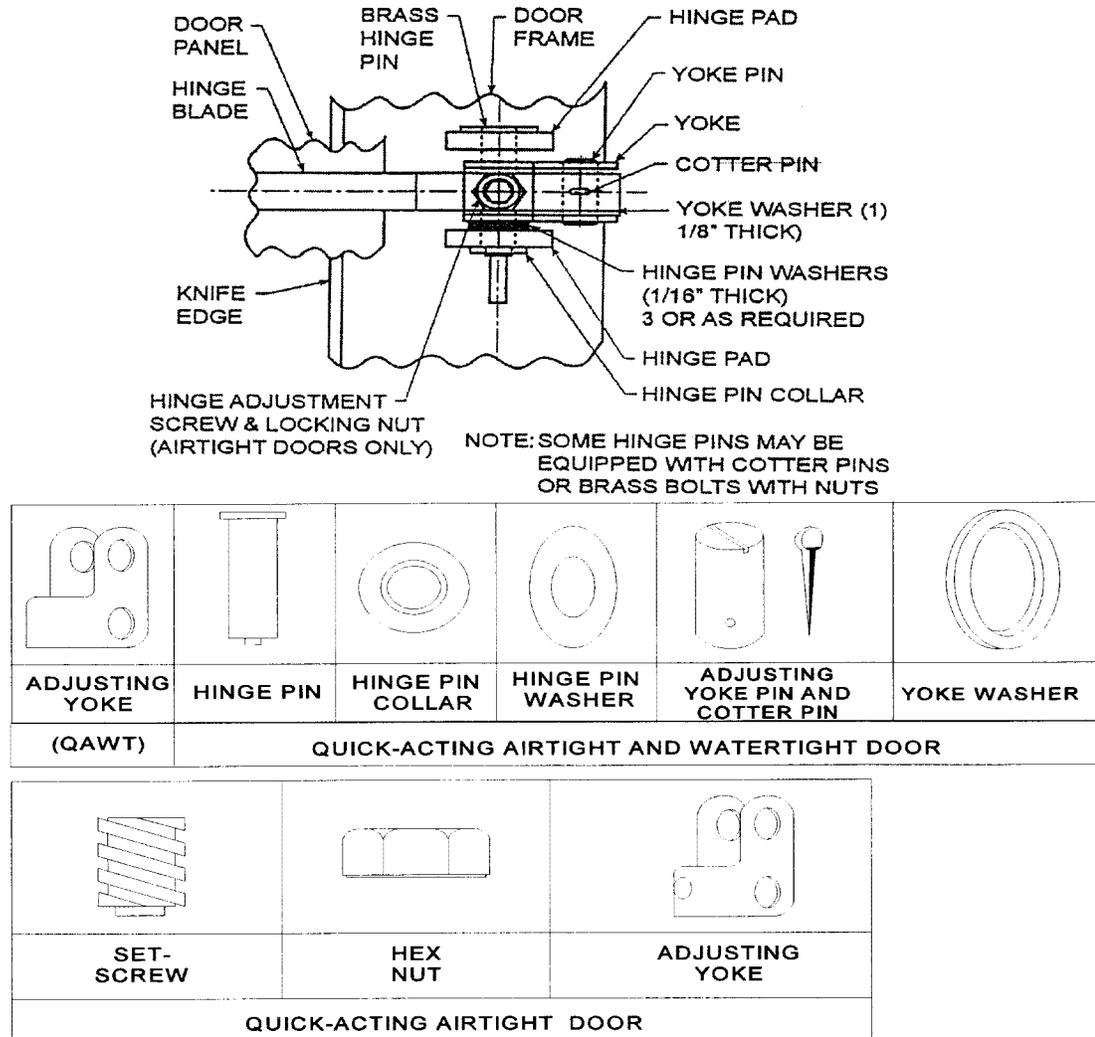
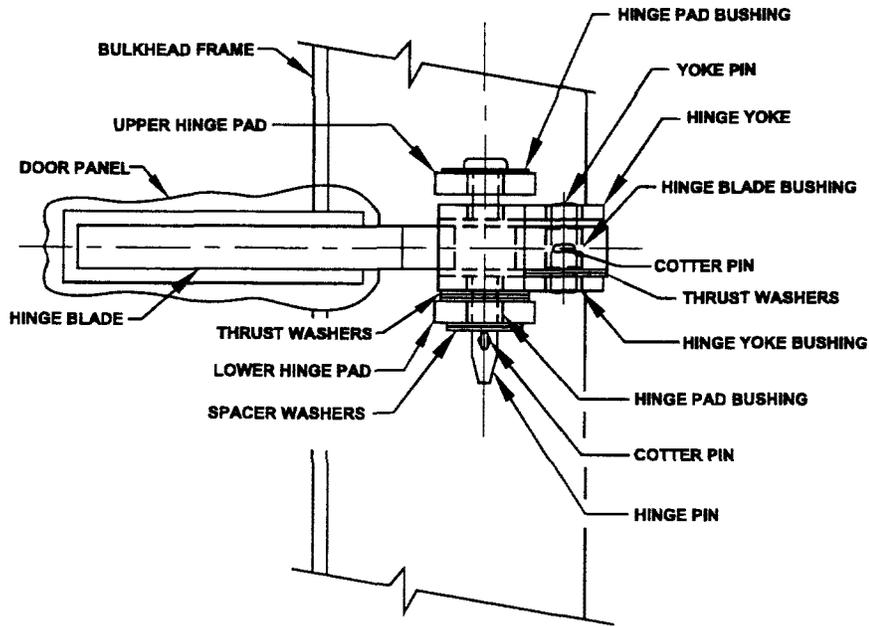


Figure 3-8. Watertight Door Hinge Components (For Doors Without MACHALT 167-31006 (ECP-518) or MACHALT 167-31011 (ECP-538) Installed)

- 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.

3-1.9.2 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 3-8A](#). 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.



HINGE PIN & COTTER PIN	YOKE PIN & COTTER PIN	HINGE YOKE	HINGE PAD BUSHING
HINGE BLADE BUSHING	HINGE YOKE BUSHING	SPACER BUSHING	THRUST WASHER
QUICK-ACTING AIRTIGHT AND WATERTIGHT DOORS			

Figure 3-8A. 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 3-8A](#).

3-1.10 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 3-9](#), and accomplish the procedure in [paragraph 3-1.10.1](#), [paragraph 3-1.10.2](#), or [paragraph 3-1.10.3](#) as applicable.

3-1.10.1 Replacement of Welded Dog Wedge.

- a. Remove the door hinge pins, washers, and gasket. Place the door in a flat position.

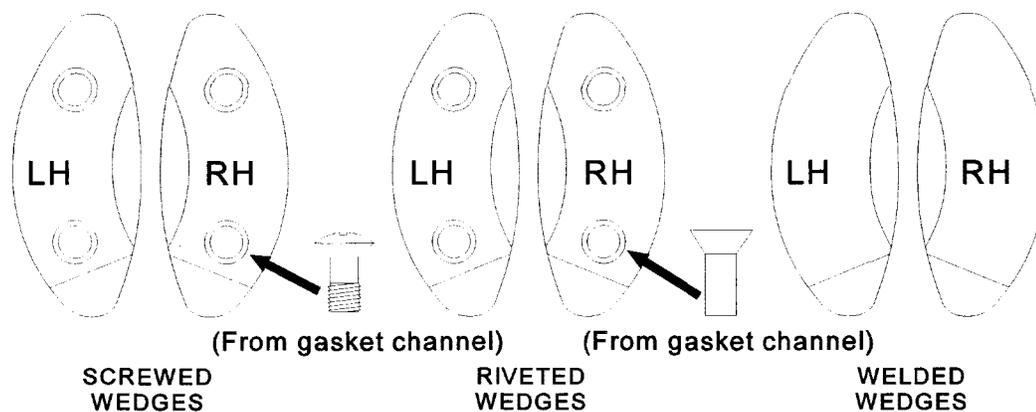


Figure 3-9. Dog Wedges

- 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 [chapter 2, paragraph 2-1.9](#), for procedures on making adjustments.

3-1.10.2 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 [chapter 2, paragraph 2-1.9](#), for procedures on making adjustments.

3-1.10.3 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 [chapter 2, paragraph 2-1.9](#), for procedures on making adjustments.

3-1.11 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 3-10](#). 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.

3-1.12 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 [paragraph 3-1.13](#).

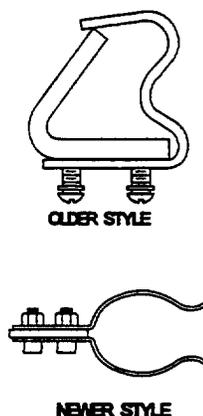


Figure 3-10. Spring Clip Assemblies

3-1.12.1 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 3-11](#).

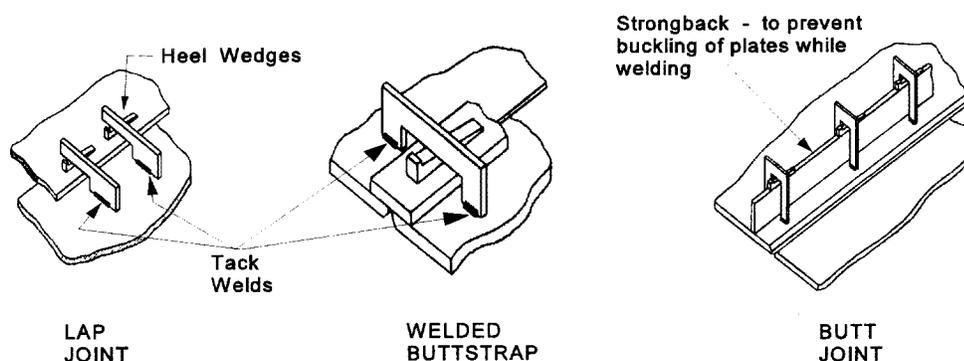


Figure 3-11. Methods of Securing Welded Structure

- 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 [chapter 2, paragraph 2-1.2](#) through [paragraph 2-1.6.4](#), 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.

3-1.12.2 Installation of the Door Frame.

3-1.12.2.1 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 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.

3-1.12.2.2 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 3-12](#).
- 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 3-1.12.1](#).) Install strips of dielectric tape along the entire edge of the clear opening. Cut curved pieces for the corners. See [figure 3-12](#).

- 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.

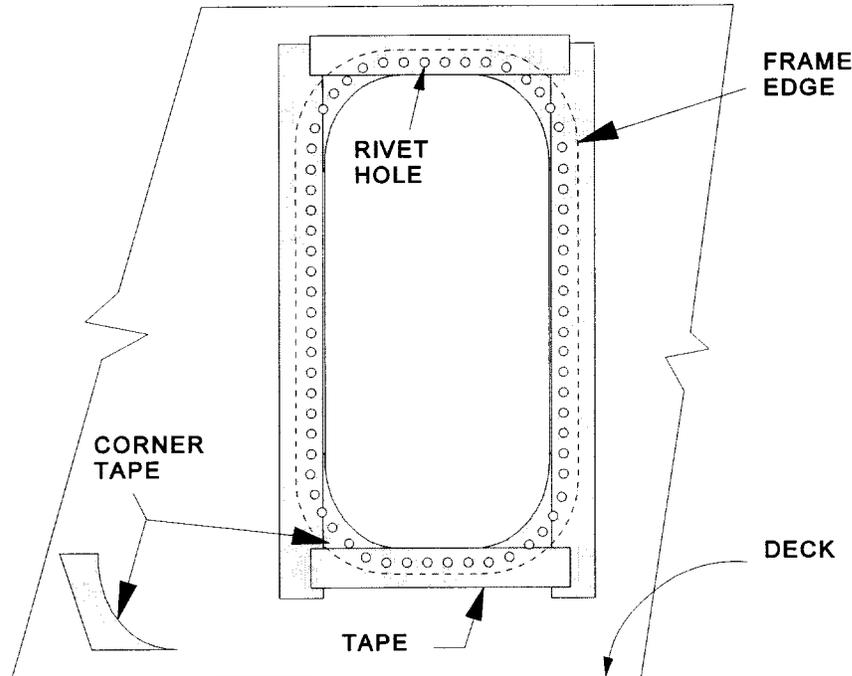


Figure 3-12. Dielectric Tape Installation

- 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.

3-1.12.3 Door Installation.

- a. Install the door to the frame and make adjustments. Refer to [paragraph 3-1.4](#) through [paragraph 3-1.8](#) for installation procedures. Refer to [chapter 2, paragraph 2-1.9](#), for procedures on making door dog adjustments.
- b. Conduct a chalk test. (Refer to [chapter 2, paragraph 2-1.5](#).)
- 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.

3-1.13 DOOR FRAME/FLANGE ASSEMBLY REPLACEMENT. Use the following procedures for replacing a flange type watertight door frame with a new flange and frame.

3-1.13.1 Flange Type 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 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.

3-1.13.2 Installation of the Door Frame/Flange Assembly.

- 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 [chapter 2, paragraph 2-1.2](#) through [paragraph 2-1.6.4](#), 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.

3-1.13.3 Door Installation.

- a. When the paint is dry, reinstall the dogging shafts and linkage assemblies as applicable.
- b. Install the door to the frame and make adjustments. Refer to [paragraph 3-1.4](#) through [paragraph 3-1.8](#) for installation procedures. Refer to [chapter 2, paragraph 2-1.9](#), for procedures on making door dog adjustments.
- c. Conduct a chalk test. (Refer to [chapter 2, paragraph 2-1.5](#).)
- d. Install a door stop and keeper.
- e. Install a door hasp and keeper, if required.
- f. For an individually dogged door, install a wrench stowage bracket to the bulkhead outside and inside the door.

3-2. ALUMINUM DOORS.

3-2.1 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. (Refer to [chapter 2](#) for routine maintenance procedures.) If the answer to the problem is not covered in [chapter 3](#) or in the appendices, consult the appropriate technical point of contact at 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.

3-2.2 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 3-13](#), and refer to [paragraph 3-2.6](#) and [paragraph 3-2.7](#) 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 3-2.8](#) for instructions.

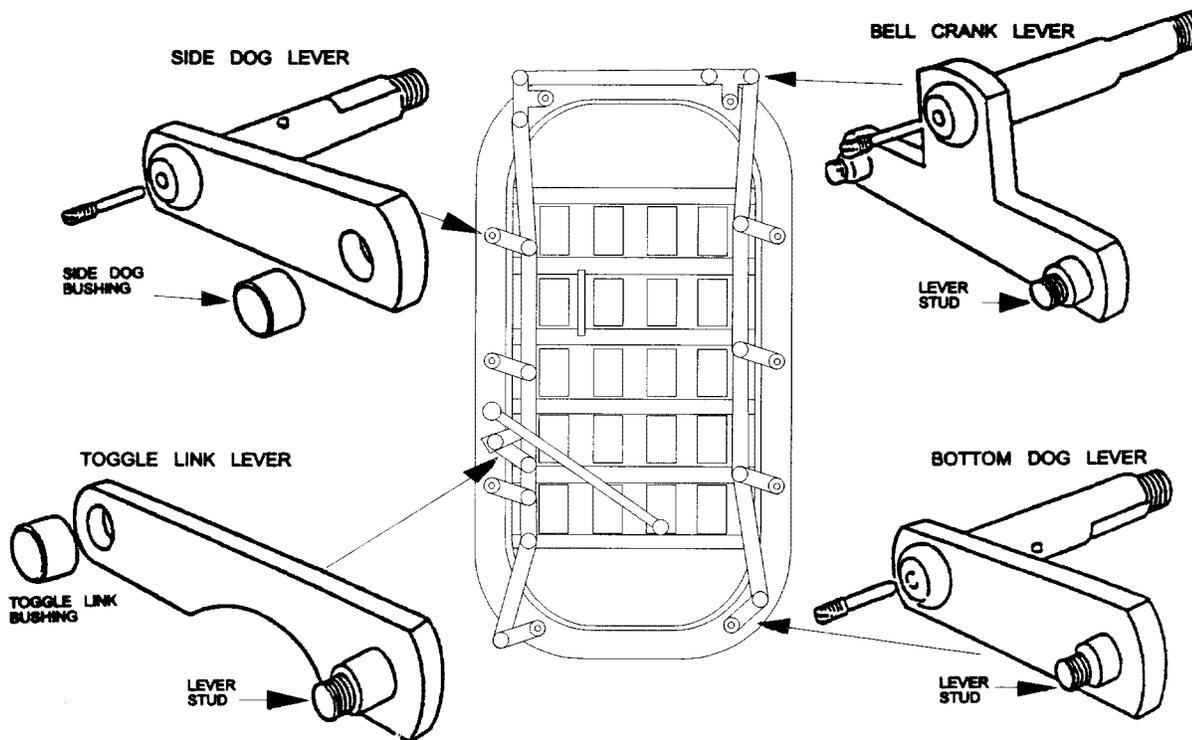


Figure 3-13. Quick Acting Door Levers

- 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 coils at the ends thinner than those in the center. This is not a sign of wear.

3-2.3 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 (refer to [appendix C](#)), but are not available through the Navy Supply System. Springs and setscrews for aluminum doors are made of stainless steel. The dog spindle and operating handle bushings on most aluminum doors are also made of stainless steel. Some aluminum doors may have stainless steel bushings with self-lubricating liners installed. However, stainless steel bushings installed in exterior aluminum doors cause galvanic corrosion inside the spindle sleeves. MACHALT 167-31004 (ECP 444) replaces the stainless steel bushings in aluminum quick-acting exterior doors with hard, anodized aluminum bushings with self-lubricating liners to reduce the effects of the galvanic corrosion caused by the use of dissimilar metals. For installation of self-lubricated bushings, refer to [paragraph 3-2.4](#). To prepare spindle sleeves and install bushings:

WARNING

Use caution when working with flammable solvent.

- a. For aluminum doors, clean with a Scotch Brite pad. Remove 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 for 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 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.

3-2.4 SELF-LUBRICATED BUSHING INSTALLATION. 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 procedure to replace dog assembly bushings with a self-lubricated bushing replacement parts kit. (Ordering information for the bushing kits is provided in [appendix C, section I](#).)

- a. Remove the existing dog assembly and dog point setscrew. (Refer to [paragraph 3-2.6](#) for quick-acting dog disassembly or [paragraph 3-2.7](#) for individual dog disassembly.) If unable to remove the existing setscrew, drill and tap at that 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 a Scotch Brite pad (for aluminum 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 or attempt to drive the bushing 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.

CAUTION

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). Refer to [paragraph 3-2.6](#) for quick-acting dog installation or [paragraph 3-2.7](#) 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 [chapter 2, paragraph 2-1.9](#), for watertight door dog adjustments and to [chapter 2, paragraph 2-1.5](#), 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 already installed with a 1-5/16-inch flat engineer's wrench. Thread the second nut onto the spindle, and tighten against the first nut with another 1-5/16-inch wrench.

3-2.5 OPERATING HANDLE REPLACEMENT. The operating handles of a quick-acting door should work smoothly, without excessive tightness or binding. If the 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 when 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.

3-2.5.1 Operating Handle Disassembly. Refer to [paragraph 3-1.6.1](#).

3-2.5.2 Operating Handle Repair and Replacement. To repair or replace the operating handles of a quick-acting, steel, or aluminum 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 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 the temporary repair in accordance with figure 3-14. 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.

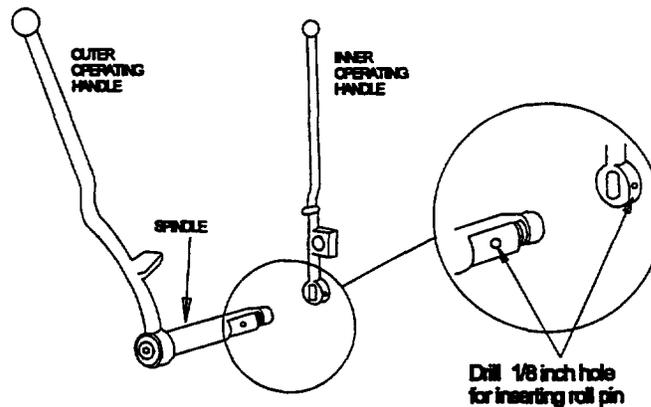


Figure 3-14. Quick-Acting Operating Handle Temporary Repair

WARNING

Exercise caution when using flammable solvent.

- c. For aluminum doors, use a nylon scrubbing pad. For all doors, clean with a rag and dry cleaning solvent.

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 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 bushings, trial fit the new bushings to the hand lever shaft. Do not attempt to force 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.

NOTE

Omit [step i](#) if installing self-lubricated bushings.

- 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 (if applicable) at this time. If using jamnuts, install the second jamnut only after all assembly/adjustments and a chalk test are completed. Refer to [chapter 2, paragraph 2-1.9](#), for watertight door dog adjustments and to [chapter 2, paragraph 2-1.5](#), 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.)

3-2.6 CONROD AND LEVER DISASSEMBLY AND REPAIR. Refer to [paragraph 3-1.7](#).

3-2.6.1 Conrod Disassembly. Refer to [paragraph 3-1.7.1](#).

3-2.6.2 Lever Disassembly. Refer to [paragraph 3-1.7.2](#).

3-2.6.3 Conrod Repair. Refer to [paragraph 3-1.7.3](#).

3-2.6.4 Lever Repair. Refer to [paragraph 3-1.7.4](#).

3-2.6.5 Lever Installation. Prepare spindle sleeves and install a flanged bushing in each sleeve as described in [paragraph 3-2.3](#) and [paragraph 3-2.4](#).

3-2.6.6 Conrod Installation. Refer to [paragraph 3-1.7.6](#).

3-2.7 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.

3-2.7.1 Individual Dog Disassembly and Repair.

- a. Remove the self-locking hex nut (or two jamnuts) and the dog handle from the outside of the door. Remove the dog from the inside of the door. See [figure 3-15](#) and [figure 3-15A](#).
- 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 aluminum doors, clean with a Scotch Brite pad. Remove all 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. Thinly coat the inside of the spindle sleeve with a silicone compound.

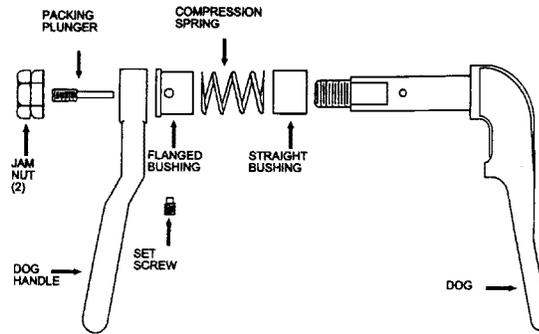


Figure 3-15. Individual Dog Assembly

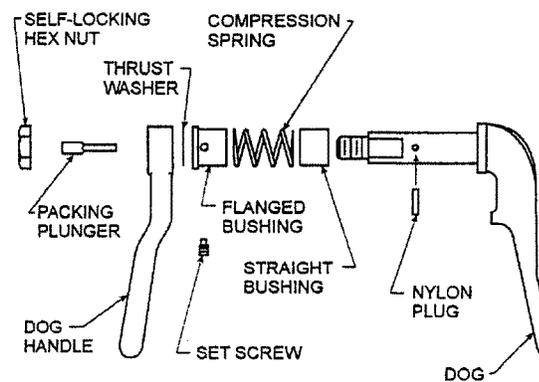


Figure 3-15A. Individual Dog Assembly with Self-Lubricating Bushings

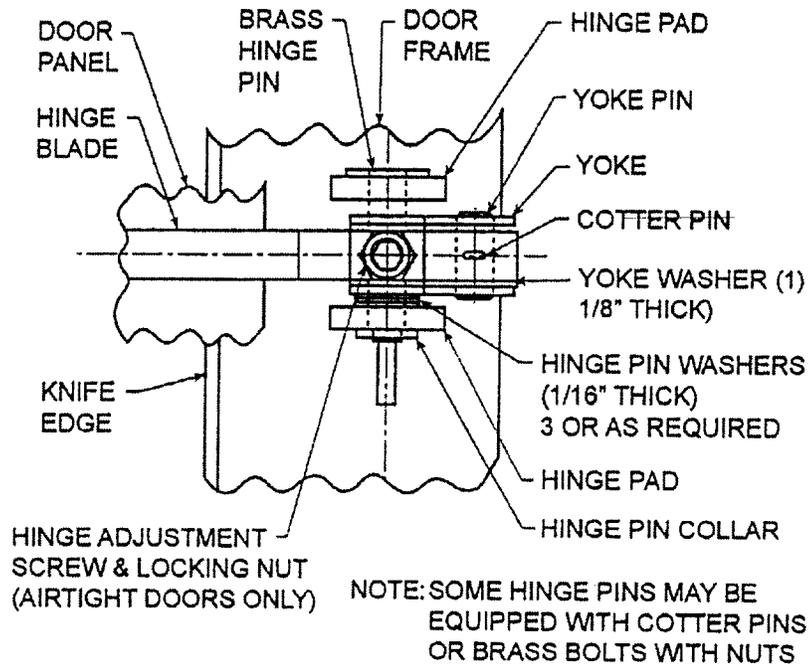
- f. Inspect all wear parts for excessive wear and obtain replacement parts as required. Refer to [paragraph 3-2.3](#) and [paragraph 3-2.4](#) for more information.
- g. Clean the dog shaft with solvent to remove all traces of grease. Use a no. 320 grit aluminum oxide cloth to remove burrs from the dog shaft.
- 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. (This step is not required where self-lubricated bushings are installed.)

3-2.7.2 Individual Dog Installation. Refer to [paragraph 3-1.8.2](#).

3-2.8 WATERTIGHT AND AIRTIGHT DOOR HINGE REPAIR. Quick-acting watertight doors are more likely to experience wear to hinge assemblies than individually dogged doors due to more frequent use. Refer to [chapter 2, paragraph 2-2.6](#), 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 the closure mechanism. Review the safety procedures described in [chapter 2, paragraph 2-1.1](#), before starting repair work on door hinges. 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 3-16](#).



ADJUSTING YOKE	HINGE PIN	HINGE PIN COLLAR	HINGE PIN WASHER	ADJUSTING YOKE PIN AND COTTER PIN	YOKE WASHER
(QAWT)	QUICK-ACTING AIRTIGHT AND WATERTIGHT DOOR				

SET- SCREW	HEX NUT	ADJUSTING YOKE
QUICK-ACTING AIRTIGHT DOOR		

Figure 3-16. Watertight Door Hinge Components

- 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. Note that 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 to avoid undue wear to hinge yokes. If stainless steel hinge pins are found, replace with brass hinge pins as soon as possible.
- 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, the door must be shimmed up or down by adding or removing one 1/16-inch washer from each hinge. See [figure 3-16](#).
- 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.

3-2.9 DOG WEDGE REPLACEMENT. Refer to [paragraph 3-1.10](#).

3-2.9.1 Replacement of Welded Dog Wedge. Refer to [paragraph 3-1.10.1](#).

3-2.9.2 Replacement of Riveted Dog Wedge. Refer to [paragraph 3-1.10.2](#).

3-2.9.3 Replacement of Machine Screwed Dog Wedge. Refer to [paragraph 3-1.10.3](#).

3-2.10 DOOR HANDLE SPRING CLIPS. Refer to [paragraph 3-1.11](#).

3-2.11 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 [paragraph 3-2.12](#).

3-2.11.1 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 3-17](#).

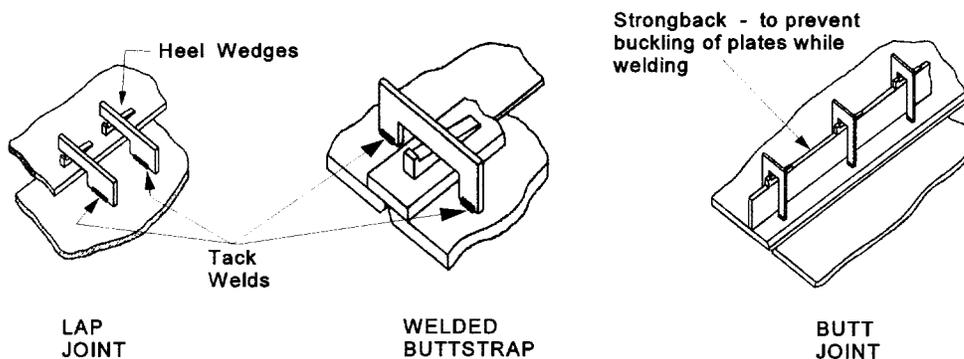


Figure 3-17. Methods of Securing Welded Structure

- 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 [chapter 2, paragraph 2-1.2](#) through [paragraph 2-1.6.4](#), 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.

3-2.11.2 Installation of the Door Frame.

3-2.11.2.1 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.

3-2.11.2.2 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 3-18](#).
- 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 3-2.11.1.](#)) Install strips of dielectric tape along the entire edge of the clear opening. Cut curved pieces for the corners. See [figure 3-18](#).
- 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.

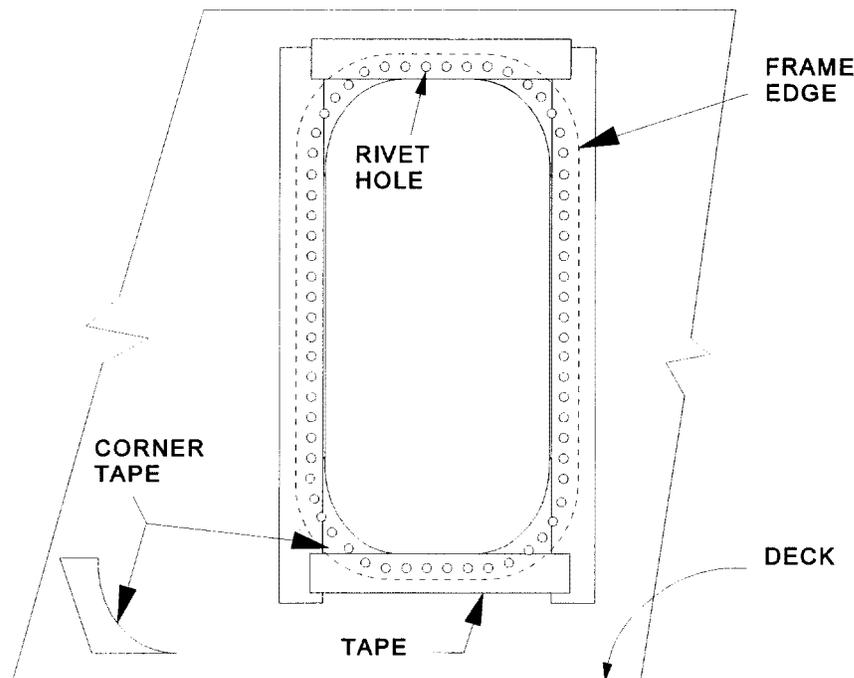


Figure 3-18. Dielectric Tape Installation

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.

3-2.11.3 Door Installation.

- a. Install the door to the frame and make adjustments. Refer to [paragraph 3-2.4](#) through [paragraph 3-2.7](#) for installation procedures. Refer to [chapter 2, paragraph 2-1.9](#), for procedures on making door dog adjustments.
- b. Conduct a chalk test. (Refer to [chapter 2, paragraph 2-1.5](#).)
- 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.

3-2.12 DOOR FRAME/FLANGE ASSEMBLY REPLACEMENT. Accomplish the following procedures for replacing a flange type watertight door frame with a new flange and frame.

3-2.12.1 Flange Type 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.

3-2.12.2 Installation of the 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 [chapter 2, paragraph 2-1.2](#) through [paragraph 2-1.6.4](#), 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.

3-2.12.3 Door Installation.

- a. When the paint is dry, reinstall the dogging shafts and linkage assemblies as applicable.

- b. Install the door to the frame and make adjustments. Refer to [paragraph 3-2.4](#) through [paragraph 3-2.7](#) for installation procedures. Refer to [chapter 2, paragraph 2-1.9](#), for procedures on making door dog adjustments.
- c. Conduct a chalk test. (Refer to [paragraph 2-1.5](#).)
- d. Install a door stop and keeper.
- e. Install a door hasp and keeper, if required.
- f. For an individually dogged door, install a wrench stowage bracket to the bulkhead outside and inside the door.