

# CHAPTER 3

## SHIP COMPARTMENTATION AND WATERTIGHT INTEGRITY

**Learning Objectives:** Recall the definitions of terms used to define the structure of the hull of a ship and the numbering systems used for compartment number designations. Identify the different types of watertight closures and recall the inspection procedures for the closures. Recall the requirements for the three material conditions of readiness, the purpose and use of the Compartment Checkoff List (CCOL) and damage control closure log, and the procedures for checking watertight integrity.

A ship's ability to resist sinking after sustaining damage depends largely on the ship's compartmentation and watertight integrity. When these features are maintained properly, fires and flooding can be isolated within a limited area. Without compartmentation or watertight integrity, a ship faces almost certain doom if it is severely damaged and the emergency damage control (DC) teams are not properly trained or equipped.

In this chapter, you will be introduced to compartmentation, material conditions of readiness,

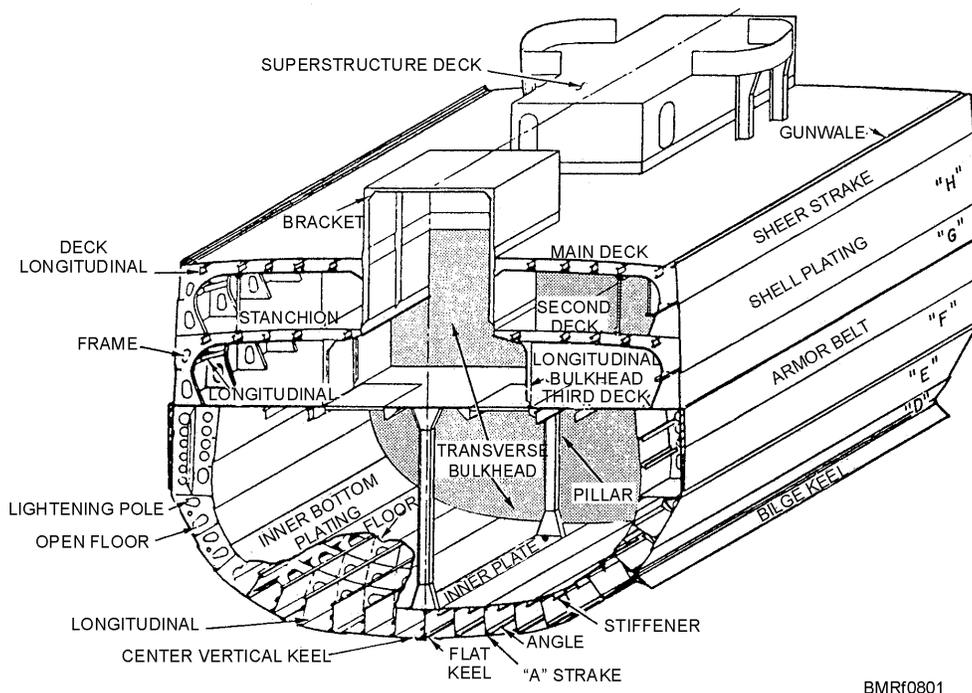
watertight integrity, and how they relate to each other. You will also learn about compartment checkoff lists, the DC closure log, the proper care of access closures and fittings, compartment inspections, the ship's draft, and the sounding and security patrol watch. The information in this chapter will assist you in completing your personnel qualification standards (PQS) for basic damage control.

### COMPARTMENTATION

**Learning Objective:** Recall the definitions of terms used to define the structure of the hull of a ship and the numbering systems used to identify the different compartments of a ship.

The compartmentation of a ship is a major feature of its watertight integrity. Compartmentation divides the interior area of a ship's hull into smaller spaces by the use of structural members.

Refer to figure 3-1 while reviewing the information on structural members.



**Figure 3-1. Illustrative hull structure.**

The keel is the backbone of the ship. The keel does not extend below the ship's bottom. Its usual shape is that of an I-beam. All other members used in constructing the hull are attached, either directly or indirectly, to the keel.

The athwartship structure consists of transverse frames and floors. The floors run outboard from the keel to the turn of the bilge (where the bottom turns upward). This is where they are attached to the transverse frames that extend upward to the main deck.

Frames, running parallel with the keel, are known as longitudinal frames. From the turn of the bilge up the sides, they are called stringers. The network of floors and longitudinal members resembles a honeycomb and is known as cellular construction, which greatly strengthens the bottom. When plating covers the honeycomb structure, double bottoms are formed. The space between the inner and outer bottoms (known as tanks) is used for liquid stowage. The forward end of the keel is extended upward in the stem. The after end has a similar extension, called the sternpost. The part of the stem above water is the prow; the forward edge of the stem is the cutwater.

The interior of a ship is divided into compartments by vertical walls, called bulkheads, which run both transversely and longitudinally. Most bulkheads are merely partitions, but transverse watertight bulkheads are spaced at appropriate intervals. These structural bulkheads extend from the keel to the main deck and from side to side. They provide extra transverse stiffening and partition the hull into independent watertight sections. Large ships have a series of longitudinal side bulkheads and tanks that provide protection against torpedoes. The outer tanks usually are filled with oil or water. The inner tanks, which are called voids, are empty. The innermost bulkhead is called a holding bulkhead. When a torpedo hits, the outer tanks, although ruptured, absorb enough energy from the explosion that the holding bulkhead will remain intact. This helps to prevent flooding of the vital spaces.

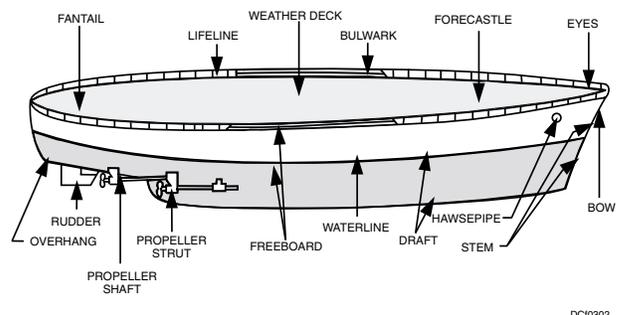
The hull plating is fastened to the framework in longitudinal rows, called strakes. The keel forms the center strake. The strakes are lettered, beginning with the A-strake on either side of the keel and extending up to the main deck. Some of the strakes also have names. The A-strake is called the garboard strake; the strake along the turn of the bilge is the bilge strake; the uppermost strake is the sheer strake.

As stated, the projecting keel, running along the bottom near the turn of the bilge, is called the bilge keel. The purpose of the bilge keel is to reduce rolling of the ship.

**NOTE**

A ship **rolls** from side to side. A ship **itches** when it goes up and down fore and aft. A ship **yaws** when the bow swings to port and starboard because of wave action.

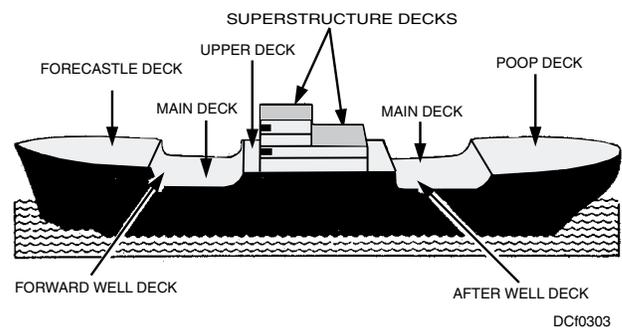
The upper edges of the sides where the sheer strakes join the main deck are called the gunwales (rhymes with funnels). The foremost part of the ship, where the gunwales join the stem, is known as the eyes of the ship (fig. 3-2). Where the gunwales curve inward to the sternpost are the port and starboard quarters.



**Figure 3-2. Hull terms.**

The water level along the hull of a ship afloat is the waterline. The vertical distance from the keel to the waterline is the ship's draft. Freeboard is the distance from the waterline to the main deck.

The floors of a ship are called decks (fig. 3-3). Decks divide the ship into layers and provide additional hull strength and protection for internal spaces. The lower surface of each deck forms the overhead (never the ceiling) of the compartment below. Compartments are the spaces within a ship.



**Figure 3-3. Weather decks.**

A steel deck is made of strakes running fore and aft. The outboard strake in the deck plating is composed of stringer plates, which are welded or riveted to the side plates and are, therefore, important strength members. Decks are supported by transverse frames (deck beams) and by longitudinal (deck) girders. Vertical steel pillars that are called stanchions provide other means of deck support. These are mounted one above the other or one above a strength bulkhead. (The short posts used as lifeline supports also are called stanchions.) Decks usually are arched from the gunwale to the centerline to provide for drainage of water and to strengthen the deck.

A deck or part of a deck exposed to the weather is called a weather deck (fig. 3-3). Bulwarks are solid fencing along the gunwale of the main (weather) deck. Bulwarks are fitted with freeing ports (scuppers) to allow the water to run off during heavy weather.

A deck that extends from side to side and stem to stern is a complete deck. In aircraft carriers the uppermost complete deck is the flight deck, from which aircraft take off and land. In all ships (except for aircraft carriers) the uppermost complete deck is the main deck. In aircraft carriers the hangar deck is the main deck. The hangar deck is the deck on which aircraft are stowed and serviced when not on the flight deck.

The first complete deck below the main deck is the second deck (fig. 3-4), the next the third, the next the fourth, and so on.

A strength deck is a complete deck (usually the main deck) designed to carry not only deck loads on it but also the hull stresses. The damage control deck is the lowest deck having access through the main transverse bulkheads, from forward to aft. The main repair equipment and the principal facilities for the control of

flooding, sprinkling, and pumping under conditions of damage are located on the damage control deck. The DC deck is either the second or third deck on most ships.

The definition and location of the decks in modern ships (figs. 3-3 and 3-4) are as follows:

**FORECASTLE** (pronounced folk'sul): Forward section of the main deck, generally extending from the stem aft to just abaft the anchor windlass.

**HALF DECK**: Any partial deck between complete decks.

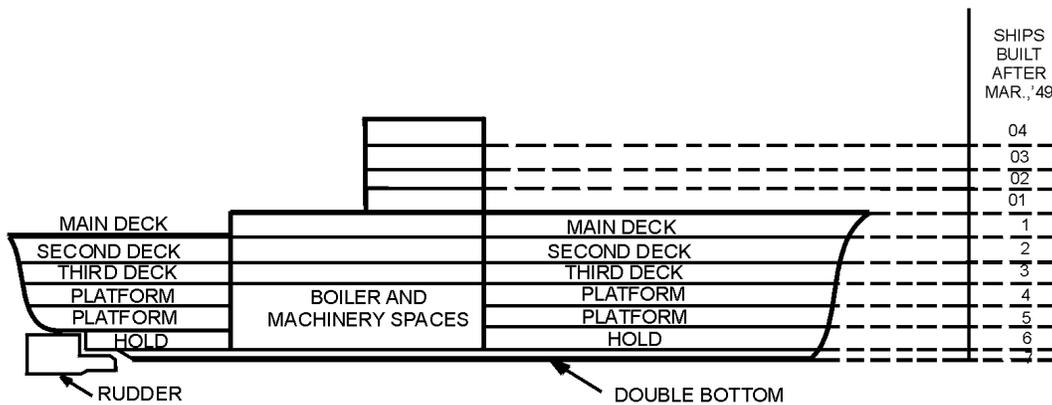
**PLATFORMS**: Partial decks below the lowest complete deck. They are usually broken to admit machinery or other spaces and are called platform decks or just platforms. They are numbered downward, as first platform, second platform, and so on.

**FLATS**: Plating or gratings installed only to provide working or walking surfaces above bilges.

**LEVELS**: Level is a general term used to designate deck heights above the main deck. The first level above the main deck is the 01 (pronounced oh-one) level, the second the 02 level, and so on. Different decks at a particular level, however, carry different names. For example, both a poop deck and a boat deck (usually) are on the 01 level.

**UPPER DECK**: A partial deck extending from side to side above the main deck amidships. It is part of the superstructure, which is the part of a ship's structure above the main deck, exclusive of masts, yards, stacks, and related parts. The side plating extends upward to the upper deck.

**SUPERSTRUCTURE DECK**: A partial deck above the main, upper, or forecastle deck that does not extend to the sides of the ship (if it does, it does not have the side plating carried up to it.).



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Figure 3-4. Deck numbering system.

**POOP DECK:** A partial deck above the main deck located all the way aft.

**FORWARD WELL DECK:** Forward part of the main deck between the upper deck and forecastle.

**AFTER WELL DECK:** Between the upper deck and the poop deck.

**GALLERY DECK:** First deck or platform below the flight deck.

**QUARTERDECK:** The quarterdeck is not an actual deck, but an area designated by the commanding officer for the conduct of official functions. It is the station of the officer of the deck in port and usually is on the main deck at the starboard gangway.

#### **NOTE**

Companionways (ladders) lead from one deck level to another. They may or may not be covered by hatches.

The number of compartments into which the decks and bulkheads subdivide the ship's interior area depends upon how many the ship's mission will allow. Since the compartments are both above and below the waterline, when the degree of compartmentation on a ship is increased, the ship's resistance to sinking is also increased.

Compartmentation serves the following functions:

- Allows for more effective control of fires and floods.
- Strengthens the ship's structure.
- Helps defend against a chemical, biological, and radiological (CBR) attack.
- Segregates various ongoing activities.
- Provides underwater protection by the use of tanks and voids to help control the ship's buoyancy and stability.

Most large combatant ships have an armor belt to protect the vital machinery spaces. Armor plating may reduce the ship's speed or have an adverse effect on the operation of the ship. Aircraft carriers are a prime example where excessive armor plating would interfere with the ship's operation by reducing the ship's speed. Therefore, armor plating on aircraft carriers is reduced, while compartmentation is increased to compensate for the reduction of armor.

## **REVIEW QUESTIONS**

- Q1. The keel is the backbone of the ship.
1. True
  2. False
- Q2. What is the forward edge of the stem called?
1. Bow
  2. Garboard
  3. Scupper
  4. Cutwater
- Q3. The vertical distance from the keel to the waterline of a ship is known by what term?
1. Draft
  2. Freeboard
  3. Stability line
  4. Buoyancy depth
- Q4. The first level above the main deck is called the 02 level.
1. True
  2. False
- Q5. Compartmentation is the design factor on a ship that allows for more effective control of fires and floods.
1. True
  2. False

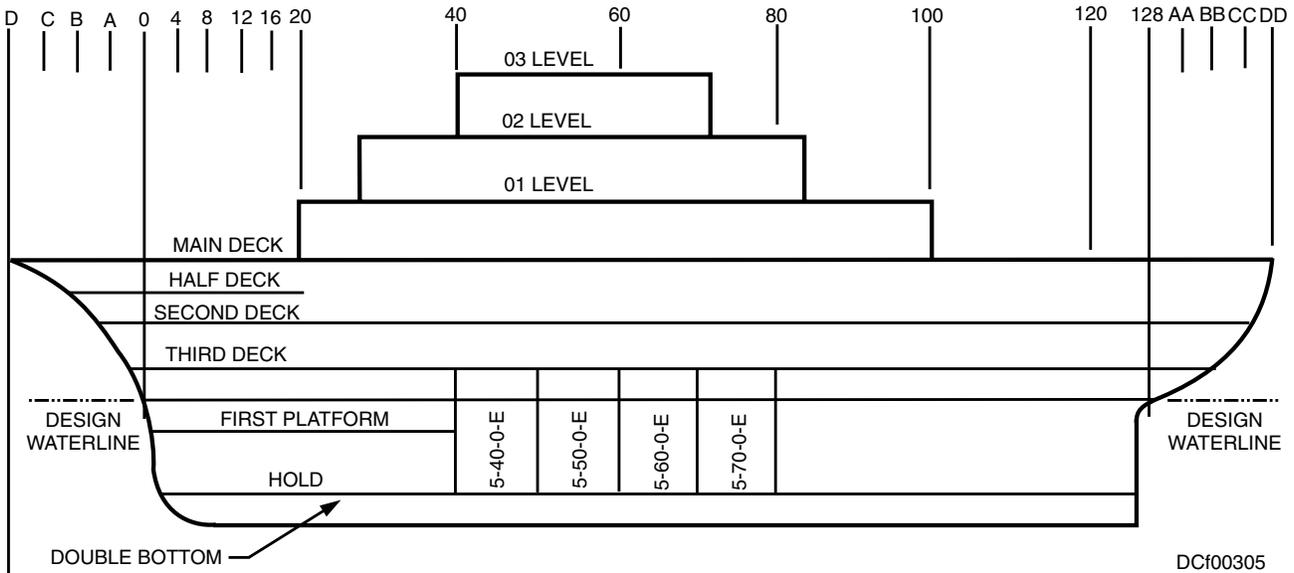
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## **COMPARTMENT NUMBERING**

**Learning Objective:** Recall compartment number designations for ships built after March 1949.

Compartments on Navy ships are numbered for identification following a standard system. Each compartment has a four-part number separated by hyphens; the four parts indicate the following:

1. The deck upon which the compartment is located.
2. Location of the compartment by frame.
3. The position of the compartment relative to the ship's centerline.
4. The compartment use.

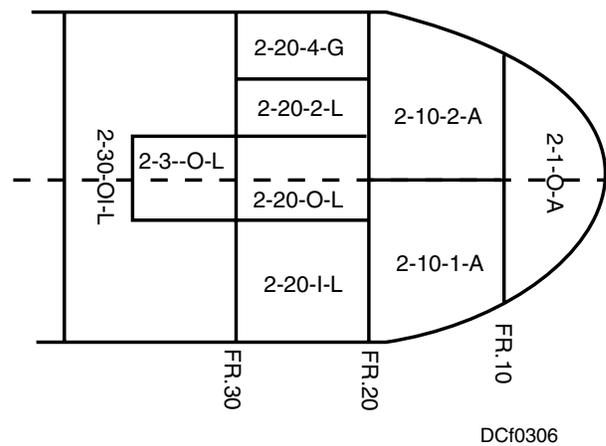


**Figure 3-5. Frame numbering.**

All frames forward of the forward perpendicular are identified by a capital letter, starting with A (fig. 3-5). These frames are identified by starting with the first frame forward of the forward perpendicular and working forward. The frames aft of the aft perpendicular are identified with double capital letters, starting with AA. Starting with the first frame aft of the aft perpendicular and working aft identifies these frames. The frames between the forward perpendicular and the aft perpendicular are identified by numbers. The forward perpendicular is identified by the number 0 (zero). Each frame aft of the forward perpendicular will carry the next higher consecutive number. The last numbered frame is the aft perpendicular. If the forward boundary of a compartment is located between frames, the frame number farthest forward within the compartment is used. Compartments located on the ship's centerline carry the number 0.

Compartments completely to starboard are given odd numbers, and those to port are given even numbers. Where two or more compartments have the same deck and frame number, they have consecutively higher odd or even numbers, as applicable, numbering from the centerline outboard. In this instance, the first compartment to starboard is 1, the second is 3, and so on. To port of the centerline they are numbered 2, 4, and so forth. When the centerline passes through more than one compartment, each of which has the same frame number, the compartment having the forward bulkhead through which the centerline passes carries

the number 0; the others are numbered 01, 02, 03, as applicable (fig. 3-6).



**Figure 3-6. Compartment designations.**

The last part of the compartment number is the letter that identifies the primary usage of the compartment. On dry- and liquid-cargo ships, a double letter is used to designate cargo spaces. The double letter will differentiate them from spaces containing the same commodity for use by the ship. Fuel oil and JP-5 jet fuel are two examples.

Compartment usage in the post-1949 system is shown in table 3-1.

Access closures are numbered in the same manner as compartments, except that the letter designating the compartments use is omitted (example: 2-175-3).

Table 3-1. Compartment Letters for Ships

Letter	Type of Compartment	Examples
A	Stowage spaces	Store and issue rooms; refrigerated compartments
AA	Cargo holds	Cargo holds and cargo refrigerated compartments
C	Control centers for ship and fire-control operations (normally manned)	CIC; plotting rooms; communications centers; pilot house; electronic equipment operating spaces; IC rooms
E	Engineering control centers (normally manned)	Main machinery spaces; evaporator rooms; steering gear rooms; pump rooms; auxiliary machinery spaces; emergency generator rooms
F	Oil stowage compartments (ship use)	Fuel- , diesel- , and lubricating-oil compartments
FF	Oil stowage compartments (cargo)	Compartments carrying various types of oil as cargo
G	Gasoline stowage compartments (ship use)	Gasoline tanks, cofferdams, trunks, and pump rooms
GG	Gasoline stowage compartments (cargo)	Spaces for carrying gasoline as cargo
J	JP-5 fuel (ship use)	Jet fuel stowage spaces
JJ	JP-5 fuel (cargo)	Spaces for carrying JP-5 fuel as cargo
K	Chemicals and dangerous materials (other than oil and gasoline)	Chemicals, semisafe materials, and dangerous materials carried as cargo or for ship's use
L	Living spaces	Berthing and messing spaces; staterooms; washrooms; heads; brig; sick bay; and passageways
M	Ammunition spaces	Magazines; handling rooms; turrets; gun mounts; shell rooms; ready service rooms
Q	Miscellaneous spaces not covered by other letters	Laundry; galley; pantries; wiring trunks; unmanned engineering; electrical and electronic spaces; shops; offices
T	Vertical access trunks	Escape trunks
V	VOIDS	Cofferdam spaces (other than gasoline); void wing compartments
W	Water stowage spaces	Drainage tanks; freshwater tanks; reserve feedwater tanks

## REVIEW QUESTIONS

- Q6. Each compartment has a four-part number separated by hyphens.
1. True
  2. False
- Q7. Compartments completely to starboard are given odd numbers.
1. True
  2. False
- Q8. The last part of the compartment number is the letter that identifies the
1. primary use of the compartment
  2. size of space inside the compartment
  3. side the compartment is on
  4. deck the compartment is on

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## WATERTIGHT INTEGRITY

**Learning Objective:** Recall different types of watertight closures and the inspection procedures for the closures.

The watertight integrity of a naval ship is established when the ship is built. “Watertight integrity” is defined as closures or fittings that prevent the ingress of water to certain compartments. This original watertight integrity may be reduced or destroyed through enemy action, storm damage, collision, stranding, or negligence. The damage control officer (engineer officer) is responsible for ensuring that the ship’s watertight integrity is not impaired through negligence. Any impairment that occurs must be corrected as soon as possible. The ship’s material condition of readiness in effect will also increase or decrease the ship’s level of watertight integrity.

## TYPES OF WATERTIGHT CLOSURES

The following list and illustrations (figs. 3-7 through 3-10) provide information on four of the many types of watertight closures on a ship. For more detailed information, refer to NAVSEA Publication S9169-AW-DCB-010.

**1. Quick-Acting Watertight Door (fig. 3-7)**—Used for routine passage and access/egress into superstructure from weatherdecks, main passageways, or manned spaces, such as Combat Information Center, Radio Central, Machinery Room, or Damage Control Central. These doors are usually placed in high traffic areas.

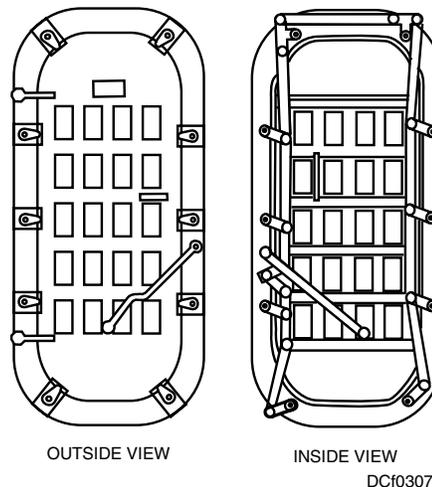


Figure 3-7. Quick-acting watertight door.

**2. Individually Dogged Watertight Doors (fig. 3-8)**—Watertight doors are either 4-, 6-, 8-, 10-, or 12-dogged doors. They provide access/egress to compartments that are not high usage spaces, which do not require rapid access, such as paint lockers, deck gear lockers, or storerooms. Ten-dog doors are usually found below the water line in order to maintain a higher degree of watertight integrity.

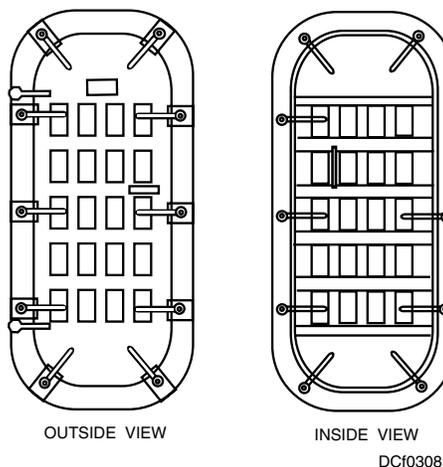
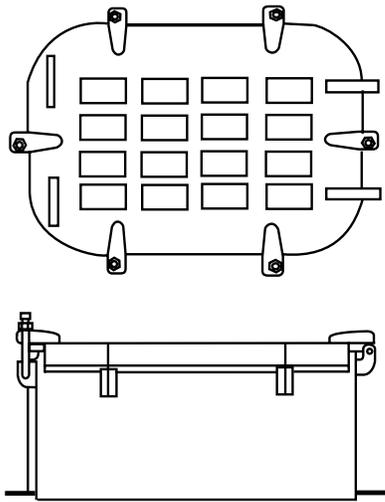


Figure 3-8. Individually dogged watertight door.

**3. Raised Watertight Hatch (fig. 3-9)**—Installed in interior and exterior areas where rapid access/egress is not required. Usually found in a low

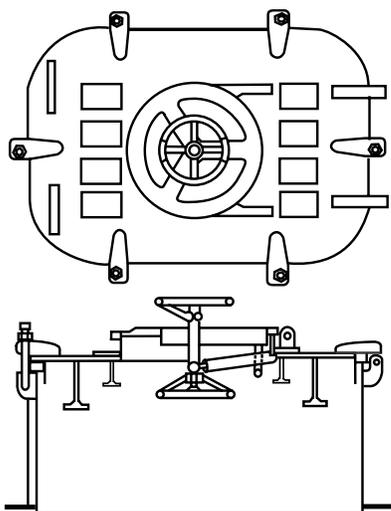


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Figure 3-9. Raised watertight hatch.

traffic area and offset in a corner of a passageway or compartment. These hatches are usually installed in compartments, which provide egress by other means. These hatches do not have escape scuttles. Usually used for stores on/offload and access for heavy equipment.

**4. Raised Watertight Hatch with Scuttle (fig. 3-10)**—Installed in interior and exterior areas where rapid access/egress are required. This hatch is usually provided in higher traffic areas than the raised watertight hatch and is offset in a corner of a passageway or compartment. These hatches have escape scuttles to provide rapid access/egress. Usually found above berthing compartments, unmanned spaces, and all deck levels requiring rapid access/egress.



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Figure 3-10. Raised watertight hatch with scuttle.

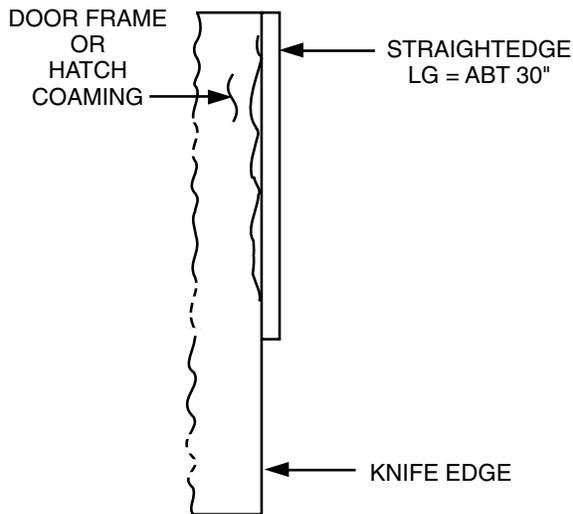
## INSPECTION OF WATERTIGHT CLOSURES

The following principles apply to inspections for all watertight closures:

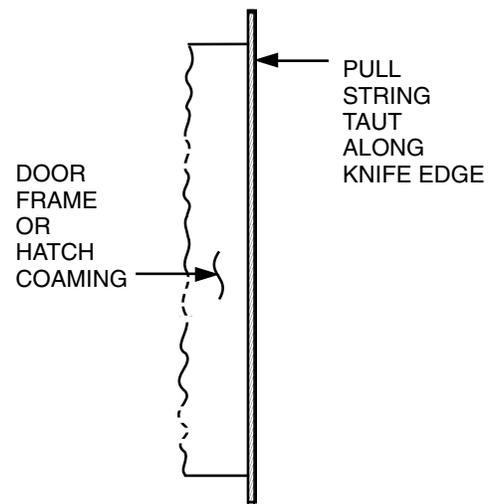
- Comply with *Navy Safety Precautions for Forces Afloat*, OPNAVINST 5100 series, which is found in each work center.
- All tag-out procedures shall be according to current shipboard instructions.
- Exercise extreme caution when working around open trunk areas.
- Perform inspection and maintenance semiannually or more frequently if adverse conditions are encountered.
- Loose, missing, or damaged parts and parts showing excessive wear must all be replaced.

Damage control petty officers, work center supervisors, and zone inspectors should routinely inspect doors, hatches, and scuttles for the following:

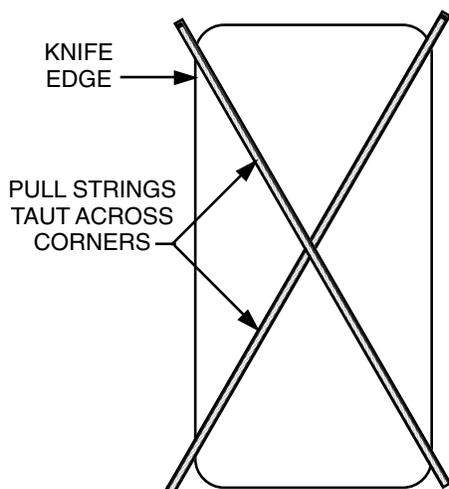
- Loose, missing, and damaged parts.
- Paint, rust, and other foreign matter on gaskets, knife-edges, and working parts, such as bushings, linkages, and brackets.
- Binding and difficult operations.
- Distortion and deterioration of metal surfaces.
- Hinge pin wear and pins that are not properly secured.
- Gasket cracks, deterioration, hardness, permanent set over 1/8 inch deep, and gaps due to shrinkage where gasket ends meet.
- No more than two joints in gaskets. Lengths of gasket must be no less than 24 inches in length.
- Obstructed access to escape scuttles.
- Packing plungers intact and stick packing adequate (except on closures with self-lubricated bushings).
- Broken or missing spring clips.
- Missing special-purpose wrenches (dogging wrenches, T-wrenches, and engineer's wrenches).



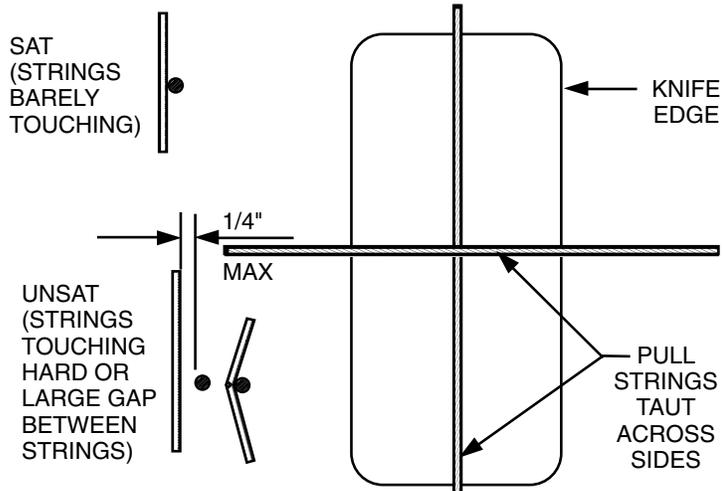
**KNIFE-EDGE INSPECTION  
USING STRAIGHTEDGE METHOD**



**KNIFE-EDGE INSPECTION  
USING STRING METHOD**



**INSPECTION FOR TWISTING**



**INSPECTION FOR WARPAGE**

**Figure 3-11. Watertight doorframe inspection.**

**NOTE**

For detailed instructions for maintenance on watertight doors, refer to Shipboard PMS Cards and NAVSEA Publication S9169-AW-DCB-010.

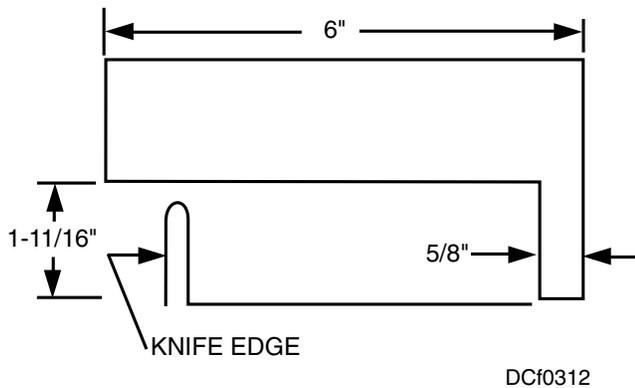
Open the fitting (fig. 3-11). Inspect the knife-edge for straightness and/or warpage using a straightedge and two lengths of string. The maximum acceptable variation for knife-edge straightness is plus or minus 1/8 inch. The maximum acceptable warpage of the doorframe is 1/4 inch. If frame/coaming warpage is excessive or if knife-edge straightness is not within

tolerances, initiate action to replace the closure. For further information, refer to NAVSEA Publication S9169-AW-DCB-010.

Inspect the knife-edge for paint, dirt, rust, or nicks. For steel knife-edges, remove paint and rust with #320 grit aluminum oxide abrasive cloth. Be sure to remove the abrasive grit with a clean rag to prevent the grit from getting embedded in the gasket. For aluminum knife-edges, remove paint with a nylon scrubbing pad and a rag only.

Inspect the entire knife-edge for proper height. A block of aluminum cut to the correct specifications is

an effective gauge for doing this (fig. 3-12). A knife-edge that is too high damages the gasket; a knife-edge that is too low damages the hinges as a result of over-adjusting the door in attempting to maintain a watertight seal. If the knife-edge is more than 1/8 inch too high or too short, it must be repaired.



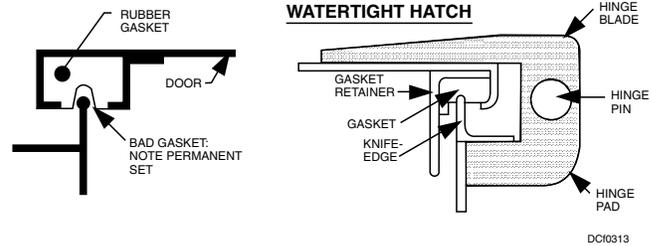
**Figure 3-12. Gauge for measuring knife-edge height.**

For steel knife-edges, repair a nicked or short knife-edge by building up the area with corrosion-resistant stainless steel electrode and filing it with a flat file. Grind a high knife-edge to shorten it to the required height. The use of power grinders on a knife-edge is not recommended. Straighten bent knife-edges by reshaping with a hammer or by bending.

For aluminum knife-edges, do not attempt to build up a short knife-edge. Report the closure to your repair division for repair. Use only a fine file to file down high knife-edges, and avoid leaving grooves in the edge. Use a steel striker plate when hammering a bent aluminum knife-edge to avoid denting the aluminum.

Rubber gaskets are installed in watertight closures to provide a watertight fit all-around when they bear against the knife-edge. Inspect the gasket (fig. 3-13) for the following:

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



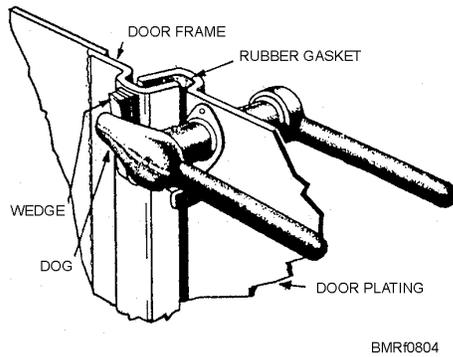
**Figure 3-13. Gasket inspection.**

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

The steps of the procedure for the chalk test for doors, hatches, and scuttles are as follows:

1. Clean the knife-edge.
2. Clean the gasket.
3. Rub chalk on the knife-edge.
4. Close and dog the closure tightly.
5. While the closure is dogged down, check for any loose dogs. If any dog is loose, it will need to be adjusted and the chalk test repeated.
6. Open the closure and observe the imprint of chalk on the gasket. The chalk imprint should be in the center of the gasket. If the chalk line is not continuous, the closure is not watertight and requires further adjustment or repair. For further information, refer to NAVSEA Publication S9169-AW-DCB-010.

Faulty gaskets are a main source of leakage through closures. Rubber gaskets (fig. 3-14) are installed in doors, hatches, scuttles, air ports, and dogged manholes to provide a tight fit all-around. When exposed to oil, grease, heat, or paint, the gaskets begin to deteriorate. Gaskets should be protected from exposure to substances or conditions that cause deterioration. Replace them immediately when they show signs of deterioration. Inspect them frequently to detect hardness, cracks, or permanent set (indentation) greater than 1/8 inch.



**Figure 3-14. Watertight door parts.**

Gaskets for bolted manhole covers and other bolted plates differ in size, shape, and material from those used with doors, hatches, scuttles, and dogged manholes. Bolted manhole covers and bolted plate gaskets should be renewed whenever they are found to be in poor condition when the cover is removed. Replacement of these gaskets at this time is particularly important since you cannot tell anything about the condition of the gasket when the manhole/plate is bolted down. The gasket may appear to be perfectly all right when actually it is in a poor condition and is providing a channel for progressive flooding. The replacement gaskets must be of the proper material. The manhole/plate bolts must be tightened up evenly all-around. A loosely secured manhole cover can be blown off by an explosion, whereas a cover that is tightly secured will not.

Be careful when moving heavy objects, such as ammunition or machinery, through watertight doors and hatches. If you are careless, you can distort the knife-edge or bearing surface of the closure by the impact of the heavy object.

The compression between a knife-edge and a gasket should be checked periodically. If necessary, adjust the closure until the compression specified in the manufacturer's technical manual is reached.

Watertight doors and hatches will retain their efficiency longer and will require less maintenance if you open and close them properly. When you close a door or hatch, secure a dog that is on the **OPPOSITE SIDE** of the closure from the hinges. Use just enough pressure to keep the door closed. Next, secure two dogs on the hinge side until snug. Then secure all the remaining dogs evenly to ensure an even compression all-around. When loosening dogs on watertight doors or hatches, loosen the dogs nearest the hinges first. This will keep the closure from springing and makes it easier to operate the remaining dogs.

A common place for leakage is around dog spindles where the spindles pass through doorframes. There is a stuffing box for each dog spindle. The packing in the stuffing box prevents leakage. Inspect the stuffing boxes frequently to ensure that they are in good condition. Tighten the packing gland to give the correct compression of the packing. Repack the dogs when the packing gets hard or deteriorates with age. Occasional adjustment of the dogs is required to compensate for the wearing down of the wedges, which the dogs bear down on. When wedges become badly worn, you should either build them up again by gas brazing or replace them.

For a door or hatch to be watertight when it is dogged, the knife-edge or bearing surface of the closure must be centered on the gasket. The knife-edge must also bear down on the gasket firmly and evenly all-around for the closure to be watertight. The door will not be watertight if either the door or the frame is warped. Also, the closure will not be watertight if the door or hatch is not located correctly on its hinges with respect to the doorframe. Other factors governing a closure's watertight feature are whether or not the knife-edge is straight and even, whether the retainer strips are secured firmly in place, and whether the dogs are adjusted to provide equal pressure on all of the wedges when the dogs are snugly set up. If any of these parts have an incorrect fit, the frame or knife-edges may come into contact with the metallic parts of the closure and thus allow the closure to be closed in a non-watertight condition.

Some ventilation ducts have covers to isolate the ventilation system. The gaskets on these covers are subject to the same kinds of failure that access closure gaskets are. Many ventilation closures and valves installed in the ventilation ducts lack tightness because of improper seating. These fittings should be inspected on a regular basis. If you lubricate and maintain the fittings on a routine basis, the fittings will stay in good working condition indefinitely.

Throughout the ship, electric cables pass through many watertight boundaries. The watertight integrity is maintained by passing each cable through a packed stuffing tube (fig. 3-15). Usually, several cables will pass through a deck or bulkhead in a small area known as a multi-cable transit frame (fig. 3-16). The stuffing tube nearest the center of the group can be repacked only with a great deal of difficulty. It is vital, however, that the packing be replaced when necessary. If you allow bad

packing to remain in the stuffing tube, you will have provided a means for progressive flooding to take place.

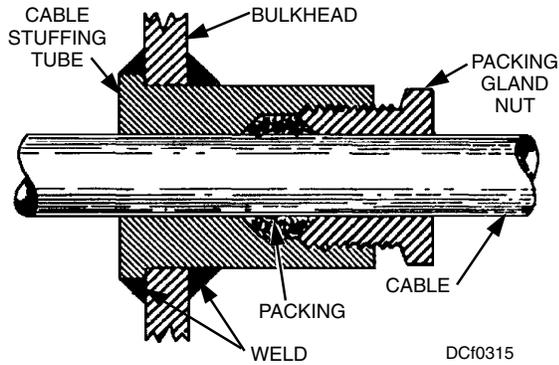


Figure 3-15. Cable penetration through watertight bulkhead.

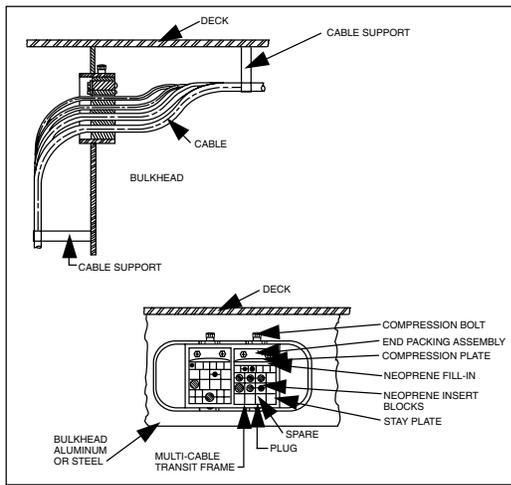


Figure 3-16. Multi-cable transit frame.

Leakage can occur where pipes pass through bulkheads and decks. Various methods are used to make the penetration points watertight. Watertight penetration points reduce the chance of progressive flooding.

Air-port covers operate basically the same as doors and hatches. You might need to tighten up the dogs on the air-port covers. If the dogs are not tight, the glass lenses of the air port can be broken by heavy seas or by the movement of the ship. When you secure an air-port cover, be sure to bring the hinge pin of the cover all the way out to the end of the hinge. By doing this, you can avoid the possibility of breaking the cover.

To replace the glass lens, drill and tap holes in the workbench top. These holes will need to be the same size as the holding bolts that are fitted through the securing lugs of the air-port frame. By drilling and tapping these holes, you will save a considerable amount of time when replacing the glass lens. Once you

secure the air-port frame to the workbench, you will be able to unscrew the retaining ring. After you remove the old glass lens, clean the threads of the frame and the retaining ring. If the frame and ring are made of composition material, apply a light coating of oil or grease to the threads. Before you insert a new glass, embed the edges of the glass in red lead putty or another approved material. When you secure the retaining ring, the putty is forced out evenly all-around the glass lens, thereby ensuring a tight fit.

## SAFETY

Safety is a major concern in whatever you do. When opening a closure, you can protect yourself by standing on the opposite side from the hinges and loosening the dogs nearest the hinge first. You will then find it easier to loosen the other dogs, and the door will not hurt you if there is an explosion within the compartment. The hinges help to keep the door from blowing open. If you are on the hinge side of the door when an explosion occurs, you will be caught between the door and the bulkhead.

Each closure has a safety device. Some hatches have stanchions; others have locking latches. Both devices use toggle pins to secure them in place. Be sure that the toggle pins are in place at all times when the hatch is open. Watertight scuttles have a safety device known as a bracing link assembly. Make sure that the bracing link assembly is in good operating condition at all times. When exiting a compartment through a scuttle, do not grab hold of the scuttle to pull yourself through. If the bracing link assembly fails to lock, the scuttle will fall on your head or fingers, causing considerable injury. A door catch is installed for each shipboard door. When a door is to be left open for a period of time, use the door catch. The movement of the ship could cause the door to slam shut. A door slamming shut will damage the door's gasket and could seriously injure a person. Most personnel injuries are not caused by the closure's design, but rather by an individual's carelessness.

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## REVIEW QUESTIONS

- Q9. What type of door provides access to a compartment that is not often used?
1. Lightweight aluminum door
  2. Quick-acting watertight door
  3. Raised watertight hatch with scuttle
  4. Individually dogged watertight door

- Q10. The watertight integrity of a naval ship is established when the ship is built.
1. True
  2. False
- Q11. What types of watertight closures are installed in interior and exterior areas where rapid access or egress is required?
1. Lightweight aluminum doors
  2. Quick-acting watertight scuttle
  3. Raised watertight hatch with scuttle
  4. Individually dogged watertight doors
- Q12. A successful chalk test does not guarantee a closure is watertight, but it does provide a reasonable assurance of watertight integrity.
1. True
  2. False

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## MATERIAL CONDITIONS OF READINESS

**Learning Objective:** Recall the requirements for the three material conditions of readiness.

The term *material condition of readiness* refers to the degree of access and system closure in effect at any given time. The securing of access fittings or systems limits the extent of damage that could occur to a ship.

### MATERIAL CONDITIONS XRAY, YOKE, AND ZEBRA

For damage control purposes, naval ships have three material conditions of readiness. Each condition represents a different degree of tightness and protection. These titles have no connection with the phonetic alphabet. Furthermore, the titles are used in all spoken and written communications that concern material conditions.

#### Material Condition XRAY

Condition XRAY provides the least amount of protection. It is set when the ship is in no danger of attack. Examples are when the ship is at anchor in a well-protected harbor or when secured at a home base during regular working hours.

#### Material Condition YOKE

Condition YOKE provides more protection than condition XRAY. It is set and maintained at sea during peacetime and in port during wartime. It is also maintained in port during peacetime outside of regular working hours.

#### Material Condition ZEBRA

Condition ZEBRA is set before leaving or entering port during wartime. It is also set immediately, without further orders, when manning general quarters (GQ) stations. Also, condition ZEBRA is set to isolate and control fires and flooding when the ship is not at GQ stations.

### CLASSIFICATION OF FITTINGS

All watertight, airtight, fire-tight, and fume-tight access fittings will be classified. Each classification applies to a certain group of fittings. Although the fittings are usually classified by a basic classification, a select group of closures within each of the three material conditions of readiness will be modified. The purpose of the modified closures is to allow access to a space that is secured because of the material condition that is set. Once a material condition is set, no fitting within the condition is to be opened, except as noted. Closures that are not modified require permission of the commanding officer to be opened. Permission to open a closure is obtained through the damage control central (DCC) watch or the officer of the deck (OOD) when the ship is not manning the GQ stations. With approval of the damage control assistant (DCA), repair party officers control the opening and closing of all fittings in their assigned areas when the ship is at GQ. Any change in the status of a fitting must be reported to DCC so the ship's DC closure log may be updated. You may open a modified closure without any special authorization. However, you are not authorized to leave the closure open unattended. Through careful attention to these procedures, a ship's watertight integrity can be maintained at a safe level.

The following discussion will help you understand that various groups of fittings are assigned different classifications. Also, you will know when you may or may not open a fitting that has a certain classification.

#### XRAY Fittings

XRAY fittings are marked with a black X and are secured during conditions XRAY, YOKE, and

ZEBRA. Ship personnel must have special authorization to open these fittings. The black X identifying an XRAY classification should be on the following closures:

- Doors and hatches to storerooms and stowage spaces, including cargo ammunition spaces
- Hatches that are provided with a scuttle and lead to magazines and handling rooms
- Bolted-plate manhole covers
- Escape scuttles not covered elsewhere
- Doors and hatches located only on the weather deck and below that are used to strike down stores and ammunition
- Access to an aircraft fueling station compartment
- Access to escape trunks in machinery spaces
- Access to the arresting gear machinery room
- Access to the eductor room
- Access to the capstan and winch control room
- Access to the chain locker
- Access to the stores elevator
- Access to the catapult machinery room
- Access to forced draft blower rooms
- Access to fan rooms

CIRCLE XRAY fittings are marked with a black X inside of a black circle. These modified closures are secured during conditions XRAY, YOKE, and ZEBRA. However, personnel may open these fittings without special authorization when proceeding to battle stations or as required in routine inspection checks. You may open these closures, but you must secure them immediately after use.

CIRCLE XRAY closures and fittings are marked with a black X inside of a black circle. These closures and fittings are as follows:

- Doors to magazines and handling rooms
- Hatches that do not have a scuttle and lead to magazines and handling rooms
- Access to the missile handling and check-out area compartments
- Scuttles in hatches to the shaft alley, pump rooms, magazines, and handling rooms
- Access to the gas and fuel station and filter rooms

- Access to the oxygen-nitrogen rooms (compressor and producing)
- Access to the switch gear room, ammunition hoist, and elevators
- Access to the underwater log room
- Access to the equipment rooms that are unoccupied
- Scuttles for passing ammunition

### **YOKE Fittings**

YOKE fittings are marked with a black Y and are secured during conditions YOKE and ZEBRA. You must have proper authorization to open fittings with this classification when the ship is at condition YOKE or ZEBRA.

YOKE closures and fittings marked with a black Y are as follows:

- Hatches that are provided with a scuttle and lead to shaft alleys and pump rooms
- Alternate accesses to machinery rooms
- Weather deck hatches not classified as XRAY
- Some alternate accesses on the DC deck and above
- Access to the windlass room
- Access to the generator rooms
- Access to the air compressor room
- Access to the air-conditioning machinery room
- Access to the refrigeration machinery room
- Access to the elevator machinery room
- Access to the missile director machinery room
- Access to the drying room

CIRCLE YOKE fittings are marked with a black Y inside of a black circle. These modified fittings are secured during conditions YOKE and ZEBRA. However, these fittings may also be opened without special authorization when personnel are proceeding to battle stations or as required in routine inspection checks. Again, you must secure these closures immediately after use.

CIRCLE YOKE fittings and closures marked with a black Y inside of a black circle are as follows:

- Hatches that do not have a scuttle and lead to the shaft alley and pump room
- Scuttles in the deck to the shaft alley and pump room
- Doors at the bottom of the trunk to the shaft alley and pump room
- Access to the steering gear power and ram room
- Access to the chill room

### **ZEBRA Fittings**

ZEBRA fittings are marked with a red Z, and these closures are secured during condition ZEBRA. You must have proper authorization to open fittings with this classification when the ship is at condition ZEBRA.

ZEBRA closures and fittings marked with a red Z are as follows:

- All remaining doors and hatches for routine access
- Access to all shops, labs, commissary, utility, control, and hospital spaces
- Access to all offices
- Access to equipment rooms occupied when associated control room is in use
- Main access to machinery spaces
- Access to issue rooms
- Access to the steering gear room
- Access to the enclosed operating stations
- Access to hangar and flight deck control stations
- Access to the garbage disposal room
- Access to the trash burner and bin room

CIRCLE ZEBRA fittings are marked with a red Z inside a red circle. These modified fittings are secured during condition ZEBRA. CIRCLE ZEBRA fittings may be opened with the commanding officer's permission during prolonged periods of GQ. The opening of these fittings allows evolutions such as the preparation and distribution of battle rations, opening of limited sanitary facilities, ventilation of battle stations, and access for aviation personnel to the flight deck. When open, CIRCLE ZEBRA fittings must be guarded so they may be closed immediately if necessary.

CIRCLE ZEBRA closures and fittings marked with a red Z inside a red circle are as follows:

- Limited doors or scuttles from the weather deck to the crew's galley
- Doors from aviators and flight crew ready rooms to the flight deck

DOG ZEBRA fittings are marked with a red Z inside a black D. These modified fittings are secured during condition ZEBRA and darken ship conditions. You must have proper authorization to open fittings with this classification when the ship is at either condition ZEBRA or darken ship.

DOG ZEBRA fittings marked with a red Z inside a black D are as follows:

- Doors to the weather deck, excluding those classified XRAY or YOKE, that do not have a darken ship switch or a darken ship curtain
- Air ports (portholes)

### **WILLIAM Fittings**

WILLIAM fittings are marked with a black W. These fittings are kept open during all material conditions. WILLIAM fittings are secured only as necessary to control damage or CBR contamination and to make repairs to the equipment served.

WILLIAM fittings are marked with a black W are as follows:

- Vital sea suction valves that supply the main and auxiliary condensers, fire pumps, and spaces that are manned during conditions XRAY, YOKE, and ZEBRA
- Vital valves that if secured would impair the mobility and fire protection of the ship

CIRCLE WILLIAM fittings are marked with a black W inside a black circle. These fittings are normally kept open, as is the case with WILLIAM fittings. They must, however, be secured to prevent the spread of damage and as a defense measure when a CBR attack is imminent.

CIRCLE WILLIAM fittings are marked with a black W inside a black circle are as follows:

- Doors to the pilot house, flag bridge, and signal shelter
- Ventilation systems to main and auxiliary machinery spaces, generator spaces, and other systems and fittings serving spaces in continuous use

If access to a space is through a series of hatches and/or scuttles, all of the closures that provide that access must bear the same classification as that of the space. For example, a pump room is classified as CIRCLE YOKE. This means it is open during condition XRAY and closed during condition YOKE. All hatches, scuttles, and/or doors that provide access to the pump room must also be classified CIRCLE YOKE to allow routine access to the pump room.

When a fan room door must be kept open to supply air to a fan or to exhaust air from it, the door should have the same classification as that of the fan. For example, a

fan room containing a YOKE fan has a YOKE door; a room containing YOKE and ZEBRA fans has a ZEBRA door. All other fan room doors are classified XRAY.

A classification has no bearing on the security of a space. A space classified ZEBRA may, for security reasons, be locked during condition YOKE if the space is unattended. However, the locking must be reported to the DCA or to the OOD.

Table 3-2 contains additional information on damage control closures and their classifications.

**Table 3-2. Damage Control Classifications**

<b>SYSTEM OR FITTING</b>	<b>XRAY</b>	<b>YOKE</b>	<b>ZEBRA</b>	<b>WILLIAM</b>
Air escapes	Damage control voids not containing pressure piping.			Damage control voids containing pressure piping.
Air ports		All lens frames.	Dog Zebra: Metal covers.	
Air test fittings	All.			
Aviation fuel systems (gasoline and JP-5)	All valves.			
Compressed air	Valves to counter recoil charging to gunmounts, torpedo charging valves, cutout valves to other systems not serving W fittings, elevator pressure tanks, catapult machinery, diesel engine air starting tank and test sets; control valve at compressor to main; hose outlets; compartment testing valves.			All other valves.
Damage control ballast valves	All.			
Drainage	All valves in main and secondary drainage systems; bilge suction and overboard discharge valves in machinery spaces; miscellaneous drainage valves; portable submersible pump overboard discharge connections.		All deck drain valves, plug cocks, valves, scuppers, and vent valves for plumbing drains; gravity overboard discharge valves from unit coolers and air conditioning units.	Deck drains and flap valves from operating room.

**Table 3-2. Damage Control Classifications (Continued)**

<b>SYSTEM OR FITTING</b>	<b>XRAY</b>	<b>YOKE</b>	<b>ZEBRA</b>	<b>WILLIAM</b>
Firemain, flushing, and sprinkling systems	Valves not segregating into sections and not adversely affecting pressure in main risers; valves actuating main and bilge drainage eductors; sea suction valve in pump room; sprinkling group control valves; washdown system hose valves; submersible pump priming valves; fog foam valves; hangar sprinkling valves; water curtain valves and caps; caps for fixed fog systems. (NOTE: In case firemain and drainage valves are interlocked, firemain valve is X and drainage valve is unclassified.)	Valves for segregation of firemain into port and starboard longitudinal sections, where practicable, and with two or more pumps supplying each section.	Valves for segregation of firemain into four or more sections; firemain valves to flushing system. Valves actuating drainage eductors from quarters; certain cooling water system valves.	All other firemain valves; valves to cooling water systems for vital machinery; sprinkling valves controlled by group valves; sea suction valves for fire pumps in machinery spaces and overboard discharge from gasoline tank.
Fresh water	Filling connection valves.		Root valves above machinery spaces.	Drinking fountains for machinery spaces; gun barrel and rocket launches cooling systems; all other valves unclassified.
Oil and ballast systems (fuel and JP-5 filling, transfer, and overflow systems)	All valves, except interlocking valves and those in way of pump, which shall be unclassified.			
Sounding tube deck plates and valves for voids, oil and water tanks	All.			

**Table 3-2. Damage Control Classifications (Continued)**

<b>SYSTEM OR FITTING</b>	<b>XRAY</b>	<b>YOKE</b>	<b>ZEBRA</b>	<b>WILLIAM</b>
Ventilation		Windlass and flammable material spaces.	Shaft alley, workshops, living spaces, washrooms, workspaces such as commissary, and utility spaces, issue rooms, rain clothes, athletic gear, chart and registered publication space; storerooms with heat piping. Circle Zebra to galley and one water closet forward and aft.	Circle W for machinery spaces, catapult spaces, pump rooms, aviation fuel maintenance shop, stowage battery shop, generator spaces. Vital spaces if not air conditioned. Controllable fire dampers.
Recirculating air conditioning			Same as ventilated spaces.	Steering gear, control spaces, medical spaces, squadron ready rooms, aviation suit drying rooms, and machinery enclosed operating station missile spaces.
Blow-out vent	Conventional ammunition spaces and storerooms. Circle XRAY for shaft alley, nuclear weapons, liquid propellants and toxic chemical agent spaces, and magazine shops.			
Replenishment air			Vital spaces and quarters.	Ready rooms.
Voice tubes and message passing facilities	All.			
Miscellaneous AT and WT covers			All.	

When material conditions of readiness are being set, the ship's first concern is the requirement for watertight, airtight, fire-tight, and fume-tight integrity. Living conditions and access to spaces are secondary requirements. During long periods at GQ stations, however, condition ZEBRA may, with the commanding

officer's permission, be relaxed to pass battle rations and to allow the crew to use the head facilities. The opening of certain weather deck doors permits natural ventilation to replace the stuffiness at some GQ stations with fresh air. Condition YOKE may also be modified in a similar manner when appropriate.

## REVIEW QUESTIONS

- Q13. What material condition of readiness provides the least amount of protection?
1. ZULU
  2. ZEBRA
  3. YOKE
  4. XRAY
- Q14. The three material conditions of readiness are XRAY, YOKE, and ZEBRA.
1. True
  2. False
- Q15. What material condition is set to isolate and control fires and flooding when the ship is not at general quarters station?
1. ZULU
  2. ZEBRA
  3. YOKE
  4. XRAY
- Q16. Fittings having what classification are kept open during all material conditions?
1. CIRCLE XRAY
  2. DOG ZEBRA
  3. CIRCLE YOKE
  4. WILLIAM
- Q17. What classification of fitting may be opened without special authorization when proceeding to battle stations or as required in routine inspection checks?
1. CIRCLE ZULU
  2. CIRCLE ZEBRA
  3. CIRCLE XRAY
  4. CIRCLE YOKE

CCOLs (fig. 3-17) provide an itemized listing of all classified fittings and closures used in damage control to set the specified material condition of readiness. They are originally prepared and furnished by the ship builder's design agent during the construction of a ship or class of ships. After that it is each ship's responsibility to keep the lists current. Follow the guidelines listed in the *Naval Ships' Technical Manual (NSTM)*, chapter 079, volume 2, when you check and update your CCOLs.

All compartments must have a CCOL permanently posted within them in clear view of the space access. Weather deck areas that have damage control facilities must also have a CCOL posted. The compartment name and number are entered on the list along with all classified fittings and certain other damage control facilities in the compartment that are necessary to help damage control personnel in the performance of their duties. The information listed for each of the classified fittings includes the following:

- Name of item
- Number of item
- Location of item
- Purpose of item
- Classification of item (if classified)
- Division responsible for the proper operation of each fitting

When a compartment has more than one entrance, duplicate CCOL must be posted at each entrance. The CCOLs shall be clearly labeled DUPLICATE. Partial CCOLs may be desirable when there are alcoves or areas included within a compartment. The partial CCOL list shall be clearly labeled PARTIAL. The item numbers on the partial list must correspond with the numbers on the original list.

CCOLs for the weather decks, and some other decks, may be divided by sections; for example, main deck, frame 90-120, port side. The DCA maintains a master copy of each original and partial CCOL on file in DCC. The division officer is responsible for informing the DCA when a change is required and

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## COMPARTMENT CHECKOFF LISTS

**Learning Objective:** Recall the purpose of the compartment checkoff list (CCOL) and the type of information listed on it.

**COMPARTMENT CHECKOFF LIST**

NAVSHIPS 9880/22 (REV. 2-67)

COMPARTMENT NO. 2-108-1-L		NAME: CREWS Berthing (LSD Wing Wall)			
ITEM	FITTING	NUMBER	LOCATION AND PURPOSE	CLASSIFICATION	DIVISION RESPONSIBLE
<b><u>ACCESS</u></b>					
1	WT door	2-108-1	Access to 2-96-1-L	Z	REP III
2	WT door	2-129-3	Access to 2-120-1-L	X	REP III
3	WT hatch	2-108-1	Access to 3-108-1-L	X	S
<b><u>MISCELLANEOUS CLOSURES</u></b>					
4	ATC	2-108-1	In WITH 2-108-1 used to test: 3-108-1-L 3-103-3-A 3-115-1-A	X	E
5	ATC	2-108-1	In WTD 2-108-1 used to test: 2-95-1-L	X	E
<b><u>DRAINAGE</u></b>					
6	Deck socket (remote)	2-112-1	Bilge eductor overboard discharge valve 5-112-1	X	M
7	STC	2-118-1	Sound Ball 6-108-1-W	X	R
8	Gagged scupper	2-109-1	Plumbing drain from 1-110-1-L	Z	REP III
<b><u>FIREMAIN AND SPRINKLING SYSTEM AND WASH DOWN</u></b>					
9	FMCOV	2-109-1	Cut out to FP 1-109-1	W	REP III
10	FMCOV	2-110-1	Cut out to Group IV magazine sprinkler	W	REP III
<b><u>FUEL OIL</u></b>					
11	STC	2-116-1	Sound F.O. and ball. 6-108-3-F	X	B
<b><u>REMOTE OPERATION</u></b>					
12	Remote start/stop switch	2-119-1	For exhaust blower 2-108-1	Z	REP III
<b><u>MISCELLANEOUS UNCLASSIFIED</u></b>					
13	Loud speaker		General announcing 1 MC		
14	C.P. riser terminal	2-114-1	Casualty power outlet		
15	15 lb. CO <sub>2</sub>	2-119-1	Portable fire extinguisher		
16	One OBA		In box at Fr. 110 stbd.		

Figure 3-17. Compartment checkoff list.

use of CCOL software is required as available per the requirements of *NSTM*, chapter 079, chapter 2.

Other responsibilities assigned ship personnel are as follows:

- Division officers are responsible for maintaining the list in good physical condition.
- The commanding officer, assisted by the DCA, is responsible for filling in the column marked DIVISION RESPONSIBILITY.
- The divisions concerned are responsible for securing fittings that are classified as XRAY or YOKE.
- The ship's repair parties are responsible for securing ZEBRA fittings.

### REVIEW QUESTIONS

- Q18. All compartments must have a CCOL permanently posted within them in clear view of the space access.
1. True
  2. False
- Q19. When a compartment has more than one entrance, duplicate CCOLs must be posted at each entrance.
1. True
  2. False

### DAMAGE CONTROL CLOSURE LOG

**Learning Objective:** Recall the purpose of the damage control closure log and how to use it correctly.

All ships are required to prepare and maintain a damage control closure log (fig. 3-18). To complete your General Damage Control PQS, you are required to know what the damage control closure log is and how to use it correctly. Strict discipline must be maintained in the modification of a material condition of readiness. As mentioned before, you must obtain permission before you change a material condition setting in any way. Obtain the permission from the DCA or the OOD. During GQ, repair party officers control the opening and closing of all fittings in their assigned areas. The repair party officers must keep DCC informed so the ship's damage control closure log can be kept up-to-date.

The closure log is maintained at all times, whether the ship is in port or underway. The closure log is used to show the following:

- Where the existing material condition of readiness has been modified.
- The fitting's type, number, and classification.
- The name, rate, and division of the person who requested permission to open or close the fitting.
- The date and time the fitting was opened or closed.
- The date and time the fitting was returned to its specified material condition of readiness setting.
- The name and rate/rank of the person granting permission.

D.C. CLOSURE LOG IN ACCORDANCE WITH OPNAVINST 3120.32												
PERSON REQUESTING PERMISSION			IDENTIFICATION OF FITTING			OPENED		CLOSED			PERSON GRANTING PERMISSION	
NAME	RATE	DIV	TYPE	CLASSIFICATION	NUMBER	DATE	TIME	DATE	TIME	EST TIME OPEN	NAME	RANK OR RATE
Trulson	DC2	R	WTH	X	4-75-1	06/02/01				24 hrs.	James Watson	DC1

Figure 3-18. Damage Control Closure Log record sheet.

The commanding officer prescribes the limit to which the DCA or OOD may approve the modification of a material condition of readiness. Reporting the temporary closing of a fitting that should be open is just as important as reporting the opening of one that should be closed. For example, a ZEBRA watertight hatch that is secured at the time GQ is sounded could seriously interfere with personnel trying to get to their battle stations.

The damage control closure log is normally kept on the quarterdeck in port, on the bridge at sea, and in DCC during GQ. However, if your ship has a 24-hour watch in DCC at all times, the closure log will be kept there no matter where the ship is. The closure log is updated when there is a change in the status of a classified closure or fitting. If a classified closure is to remain open for several days, it must be logged open each day. The maximum time a closure or fitting may be logged open is 24 hours.

You must keep all closures and fittings in the best possible condition at all times to maintain the ship's watertight integrity feature. Neglected closures and fittings could lead to the loss of your ship.

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### REVIEW QUESTIONS

- Q20. What person prescribes the limit to which the DCA or OOD may approve the modification of a material condition of readiness?
1. Executive officer
  2. Damage control supervisor
  3. Damage control assistant
  4. Commanding officer
- Q21. The closure log is maintained at all times, whether the ship is in port or underway.
1. True
  2. False
- Q22. The maximum time a closure or fitting may be logged open is 24 hours.
1. True
  2. False

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### METHODS OF CHECKING WATERTIGHT INTEGRITY

**Learning Objective:** Recall the procedures for checking watertight integrity.

Watertight integrity features are built into naval ships. There must be regular inspections conducted on the ship and its watertight integrity features. The ship's Planned Maintenance System (PMS) gives specific details for conducting the compartment tests and inspections. The *Naval Ships' Technical Manual (NSTM)*, chapter 079, volume 4, also covers various compartment tests and inspections. The ship's schedule of watertight integrity tests and inspections is maintained in the ship's damage control library. Refer to the above references when you schedule and conduct the required tests and inspections.

### VISUAL INSPECTION

Often you can discover holes or cracks in watertight bulkheads and decks by conducting a thorough visual inspection. If a compartment contains oil, water, or some other liquid, any leakage will be evident. Other sources for leakage include loose rivet heads, poorly caulked plate laps or stiffeners, and poorly caulked bounding angles. All leaks should be repaired as soon as possible to re-establish the ship's watertight integrity. If the repairs are beyond the capability of the ship's force repair personnel, the work should be included in the work package for the next shipyard, tender, or repair ship availability.

You will, at specified intervals, conduct a visual inspection for light leaks within most compartments on the ship. To make this inspection, completely close off the compartment and secure all lighting within the compartment. Have another person (an observer) stay inside the darkened compartment to look for light leaks. Then you will need to ensure that lighting is on in the surrounding spaces. As a rule, the light from the surrounding compartments will allow the observer to locate any serious defects. However, you might need to use portable lights to provide a higher level of illumination in some areas. The observer will also need a portable light to transit the darkened space safely.

### COMPARTMENT AIR TEST

The ship's schedule of watertight integrity tests and inspections is issued by NAVSEA for each ship. This schedule contains information on each watertight compartment and the type of test used to determine the compartment's tightness. Compartments designated for air testing are scheduled so all are tested once every 18 months for ships at least 12 years old. For ships that are less than 12 years old, the compartments are tested once every 36 months. Compartments that are

designated for air testing are provided with fittings for attaching the air test set. In the case of tanks, you may use sounding tubes or air escapes to connect the air test set. Figure 3-19 shows the air test set that is provided for shipboard use. The manufacturer's technical manual, provided with each set, gives detailed instructions for operating the air test set.

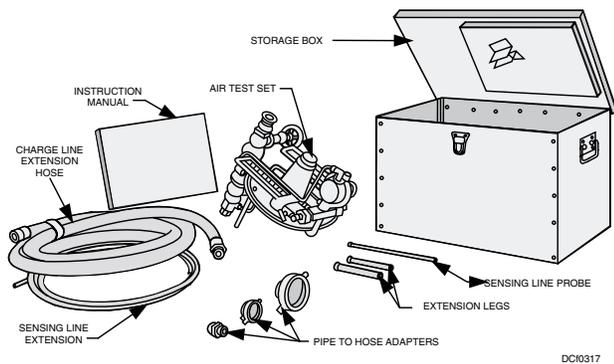


Figure 3-19. Air test set.

The information contained in the ship's schedule of watertight integrity tests and inspections must be strictly adhered to when conducting compartment air tests. The air test pressure listed in the schedule must NEVER be exceeded. You can seriously damage the structures and boundaries of the compartment being tested if the recommended pressure is exceeded.

Before starting an air test, you need to conduct a visual inspection of the compartment and repair all the leaks that you find. Notify the engineer officer, the DCA, and the OOD of your intent to conduct a compartment air test and which compartments will be involved. Also, have an Electrician's Mate (EM) assist in de-energizing the electrical push-button alarms and remote-controlled valves for sprinkling, flooding, or counterflooding systems if any are installed in the compartment to be tested. These devices have diaphragm covers and would be activated when the air test pressure is admitted to the compartment unless they had been previously de-energized.

All fittings that serve the compartment must be secured or blanked off before the air test is conducted. If any rotating shafts or other moving parts penetrate

the bulkheads, you must tighten the packing before conducting the air test to maintain the air pressure.

Make sure that the crew is aware of the compartment air test being conducted. Post signs at every possible access to the compartment(s) being tested. If an observer is stationed inside the compartment during the compartment air test, each access to the compartment must have someone posted at the access closure. The guards are to prevent the access closure from being opened until the excessive pressure within the compartment is relieved. The air test pressure used in a compartment air test is relatively low. However, a dangerous total force can be developed on quick-acting doors and hatches. Personnel should be instructed not to attempt to open quick-acting doors or hatches when a compartment is under air test. A person opening these doors or hatches while the compartment is under pressure could likely sustain severe injuries.

When conducting a compartment air test on a large compartment, use as many personnel as required to check for leaks. The personnel involved with the test need to maintain communication with each other. The X40J (salt and pepper or international orange) rig can be used, allowing you to have an isolated circuit without interruptions. When you are conducting a compartment air test, any loss of pressure in excess of the allowable drop listed in the schedule over the specified period of time indicates deterioration of the watertight integrity of the compartment. If corrective measures are beyond the capacity of ship's force, the compartment must be listed as UNSATISFACTORY. You must then request that repairs be completed during the next availability.

While the compartment is under test, leaks will be disclosed by hissing or whistling noises as the air escapes. All leaks should be located, marked, and listed for corrective action. You should repair all leaks that were found and then test the compartment again. If the allowable pressure drop is again exceeded on this test, apply a soap solution to the boundaries of the compartment and to all joints, fittings, and closures. When the air pressure is applied, bubbles will be formed by escaping air, thus indicating the location of the leaks.

The observer inside the compartment will have a lighted candle. As the observer goes over areas where leaks are suspected, the deflection of the flame will indicate the location of leaks.

Upon completion of the compartment air test, relieve the air pressure in the compartment. Be sure that all caps for the air test fittings are replaced. These caps are classified XRAY. Ensure that all temporary closures are removed from overflows, air escapes, and air vents in magazines and fuel oil tanks. The boundaries are sure to be ruptured when the space is filled or flooded if these vents and escapes are left closed. Then make the appropriate entries in the watertight integrity log if your ship has one.

## VENTILATION

Ventilation onboard ship provides comfort for the crew in their work area or berthing space. It is also used to keep electronic spaces cool. Ventilation is used to circulate air throughout the ship, and to maintain different climates and comfort zones in various areas. Quite obviously the air circulating through the ship's chillbox is maintained at a different temperature and humidity than the climate in berthing areas. Many areas of the ship contain sensitive electronic equipment that will fail if not kept properly cooled. Just as obviously, you and your shipmates cannot perform your jobs efficiently if your work environment is uncomfortable.

A variety of ventilation heaters and pre-heaters are used to warm the air coming into the ship, and air-conditioning systems and coolers are used to cool the air where necessary. Ventilation ducting and dampers are used to route the airflow where needed. Thermostats are used to monitor and maintain the appropriate temperatures. Air filters are used to filter particles such as dust from the air to keep air cleaner. It may be necessary for you to clean, inspect, lubricate, or repair or replace components of this vital system at any given time.

## REVIEW QUESTIONS

- Q23. When conducting a compartment test and inspection, you should follow the specific details provided in which of the following references?
1. Ship's watertight test instructions
  2. Ship's damage control book
  3. Planned Maintenance System (PMS)
  4. *NSTM*, chapter 79, volume 1
- Q24. The ship's schedule of watertight integrity tests and inspections is issued by NAVSEA.
1. True
  2. False
- Q25. The information contained in the ship's schedule of watertight integrity tests and inspections must be strictly adhered to when you are conducting compartment air tests.
1. True
  2. False

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## SUMMARY

In this chapter, you were introduced to ship compartmentation, material conditions of readiness, the CCOL, and the damage control closure log, along with the relationship of each to watertight integrity. As a Damage Controlman, you will use the information learned in this chapter in the daily performance of your duties. You need to have a good understanding of each topic that has been discussed. If you did not understand any of these topics, go back and review them before you move on to the next chapter.

## REVIEW ANSWERS

- A1. The keel is the backbone of the ship. **(1) True**
- A2. What is the forward edge of the stem called? **(4) Cutwater**
- A3. The vertical distance from the keel to the waterline of a ship is known by what term? **(1) Draft**
- A4. The first level above the main deck is called the 02 level. **(2) False. The first level above the main deck is called the 01 level.**
- A5. Compartmentation is the design factor on a ship that allows for more effective control of fires and floods. **(1) True**
- A6. Each compartment has a four-part number separated by hyphens. **(1) True**
- A7. Compartments completely to starboard are given odd numbers. **(1) True**
- A8. The last part of the compartment number is the letter that identifies the **(1) primary use of the compartment**
- A9. What type of door provides access to a compartment that is not often used? **(4) Individually dogged watertight door**
- A10. The watertight integrity of a naval ship is established when the ship is built. **(1) True**
- A11. What types of watertight closures are installed in interior and exterior areas where rapid access or egress is required? **(3) Raised watertight hatch with scuttle**
- A12. A successful chalk test does not guarantee a closure is watertight, but it does provide a reasonable assurance of watertight integrity. **(1) True**
- A13. What material condition of readiness provides the least amount of protection? **(4) XRAY**
- A14. The three material conditions of readiness are XRAY, YOKE, and ZEBRA. **(1) True**
- A15. What material condition is set to isolate and control fires and flooding when the ship is not at general quarters stations? **(2) ZEBRA**
- A16. Fittings having what classification are kept open during all material conditions? **(4) WILLIAM**
- A17. What classification of fitting may be opened without special authorization when proceeding to battle stations or as required in routine inspection checks? **(3) CIRCLE XRAY**
- A18. All compartments must have a compartment checkoff list permanently posted within them in clear view of the space access. **(1) True**
- A19. When a compartment has more than one entrance, duplicate compartment checkoff lists must be posted at each entrance. **(1) True**
- A20. What person prescribes the limit to which the DCA or OOD may approve the modification of a material condition of readiness? **(4) Commanding officer**
- A21. The closure log is maintained at all times, whether the ship is in port or underway. **(1) True**
- A22. The maximum time a closure or fitting may be logged open is 24 hours. **(1) True**
- A23. When conducting a compartment test and inspection, you should follow the specific details provided in which of the following references? **(3) Planned Maintenance System (PMS)**
- A24. The ship's schedule of watertight integrity tests and inspections is issued by NAVSEA. **(1) True**
- A25. The information contained in the ship's schedule of watertight integrity tests and inspections must be strictly adhered to when you are conducting compartment air tests. **(1) True**

