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CHAPTER 6 - REPAIRING DAMAGE IN ACTION

SECTION 1 - Required Information

- Ref: (a) NTTP 3-20.31, Surface Ship Survivability  
(b) NSTM Chapter 079, V2, Practical Damage Control  
(c) NSTM Chapter 079, V3, Engineering Casualty Control  
(d) NSTM 300, Electric Plant - General  
(e) Ship's Damage Control Book  
(f) Ship's Damage Control Plates (Diagrams)

6100 REQUIRED CHAPTER TABS.

- a. TAB A, Casualty Power Bill.  
b. TAB B, Casualty Power Checklist.

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## SECTION 2 - SHORING

6200 USE OF SHORING

a. Shoring is the process of placing supports against the side of, beneath or above a structure to prevent metal fatigue, sagging and bulging. Ships have often needed to support ruptured decks, build up temporary bulkheads and decks against the sea to support hatches and doors, and provide supports for equipment that has broken loose. This is accomplished largely by shoring. For additional information regarding shoring procedures, see reference (b).

6201 WHEN TO SHORE.

a. Shoring should not be immediately initiated after flooding damage. Ships are designed with inherent structural strength to resist the effects of flooding. All principal transverse and longitudinal structural bulkheads and all watertight decks are designed to withstand the maximum static pressure, which any flooding can conceivably produce. If the bulkhead or deck has been properly preserved, this pressure may result in deformation, but there will be no serious threat of failure. One or more of the following may cause bulkhead failure:

(1) If the structure is old, it may have been weakened by corrosion.

(2) The damage itself may cause some local structural weakening. This is particularly likely for structures close to an explosion.

(3) Static pressure from flooding may be exacerbated by dynamic pressure resulting from ship's movement, speed or behavior in a seaway.

NOTE: Unless one or more of the above conditions exist, there should be no reason to shore.

b. Exercise good judgment when inspecting the damaged area. Deep bulges in plating, bowed frames and stanchions, cracked seams and panting bulkheads indicate the need for shoring. Panting is a dangerous condition; it results in metal fatigue that eventually causes cracking and splitting.

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c. Carefully inspect equipment located near damage. Weakened supports under guns and machinery may not be readily noticed. These must be shored so further operation will not make the problem worse.

d. Because of ship construction, each shoring configuration will be different. Many shoring situations require the removal of interferences such as equipment, ventilation ducting or even cableways. DCC must approve and coordinate interference removal to avoid further damage or impact on other damage control evolutions in progress.

e. When in doubt, shore!

#### 6202 FUNDAMENTAL RULES OF SHORING.

a. Distribute pressure evenly on the bulkhead or deck (i.e. not concentrated at one or two points).

b. Several shores exerting pressure perpendicular to the bulkhead must back up each horizontal strong back.

c. The butt end of shores must be secured against strong, undamaged structures. Hatches, stanchions, machinery foundations, frames, girders, and armored decks may be used as anchor points. It may be necessary to build a complicated structure to reach from a bulkhead to a strong support.

d. A flooded compartment subjects the deck, all bulkheads and possibly the overhead to pressure. Consider shoring the entire containing structure with priority given to the weakest or most pressured bulkhead.

e. Pressures vary on bulkheads as the ship- and the liquid inside the compartment moves. The pressure fluctuates and tends to separate the bulkhead and shoring. No shoring job is complete until all slack is taken up and a continuous shoring watch is posted to tighten wedges as they work loose. Shoring is intended to SUPPORT warped bulkheads, not PUSH them back into shape. Excessive shoring pressure may cause a bulkhead to collapse or rupture.

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## SECTION 3 - CASUALTY POWER SYSTEMS

6300 CASUALTY POWER SYSTEM.

a. Ships are designed with an installed casualty power system which provides a means for repair party personnel to quickly respond to a damaged electrical distribution system and provide temporary emergency power to predetermined equipment considered vital to ship survivability. This system eliminates the need for time-consuming cable tracing, cutting, and splicing. The system's components include permanently installed vertical risers, bulkhead and switchboard terminals, and portable pre-staged cables and switches. Features of the casualty power systems are:

- (1) Preservation of watertight integrity.
- (2) Simplicity of installation and operation.
- (3) Flexibility of application.
- (4) Interchangeability of parts and equipment.

6301 CASUALTY POWER BILL.

a. In a damaged condition, the timely and effective response of the ship's repair parties to rig casualty power is vital to ship survivability. Never sacrifice safety for speed. Experience shows that well trained repair parties who know the systems and have practiced for emergencies will be able to rig casualty power safely and with dispatch. Conversely, unprepared/untrained repair parties lose critical hours in getting organized. Tables of normal, alternate, and emergency electrical sources, vital loads, casualty power bulkhead and riser terminals, ABTs and MBTs are included in refs (e) and (f) (Vital Load Charts and Casualty Power Diagrams: normally Plates 13 and 14). Preplanned casualty power cable routes shall be developed and included in the Chapter 6, Tab A as the ship's Casualty Power Bill.

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6302 PROCEDURE FOR RIGGING CASUALTY POWER.

a. Ensure that power is NOT available at the damaged panel or switchboard by tagging out all applicable sources of power IAW ship's instructions.

b. Ensure that all power supplies are tagged open. If a type "K" switch is installed on the panel, OPEN IT.

c. Make sure that there are no grounds or short circuits in the panel or equipment. If supply cables are damaged and no switch is available, disconnect the leads.

d. The Engineer Officer will designate the source switchboard and riser.

e. The casualty power cables should then be taken from their stowage racks and laid out, ready for connecting.

f. IAW reference (d), All personnel making connections must wear proper PPE and observe all safety precautions: 7500-volt rubber gloves, rubber boots or a rubber mat and de-metalization. Rubber boots protect against sea water, a rubber mat does not.

g. Connect all horizontal cables LOAD to SOURCE starting with the riser or bulkhead terminal at the casualty (load) and work toward the switchboard (source) riser or bulkhead terminal entering the compartment from which power will be supplied.

h. Test, then connect, the equipment to the riser or bulkhead terminal leaving the compartment. (The equipment should be the next to last thing connected after all intermediate connections, followed by the source.)

i. UNDER NO CIRCUMSTANCES is the riser terminal to be used for a connection block unless the other end of the riser is to supply the same piece of equipment.

j. Install a portable switch (if applicable; some ships may have newer one piece connectors) in the line near the casualty to kill power in the event of an emergency (e.g. class "C" fire), or for reversing leads to correct phase rotation.

k. When all cables have been connected (including the horizontal connections) to the panel or equipment to be energized, inform DCC.

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1. Hang "DANGER HIGH VOLTAGE" signs every five (5) feet on horizontal connections.

m. The DCA will request that the Bridge pass the word, "Stand clear of casualty power cables rigged between frames \_\_\_\_ and \_\_\_\_" (every 5 minutes)

n. When the operator of the designated switchboard (or Repair Electrician) receives word from Main Engine Control to "Rig and energize casualty power cables," the operator shall perform the following:

(1) Test the bulkhead terminal and rig that end ONLY.

(2) Rig the cable to the switchboard terminal after checking to make sure the switchboard casualty power circuit breaker is open.

(3) Test the casualty power terminal in the switchboard to make sure the terminal is de-energized.

(4) Prior to closing and opening the power switch, pass the word, "STAND CLEAR OF CASUALTY POWER CABLES RIGGED WHILE BEING ENERGIZED."

(5) Momentarily close and open the casualty power switch to test the casualty cable run then close the switch again.

Note: This could prevent both serious injury to someone still working on the casualty cable run and damage to the cables.

o. Report to Main Control, "Casualty power riser (or bulkhead terminal) rigged and energized." Main Control then notifies DCC.

p. Ensure that motor rotation is in the correct direction. If not, de-energize the circuit at the portable switch (if installed) and reverse any two of the three leads. (If no switch is installed, reversing the leads can be done inside the motor controller.)

#### 6303 PROCEDURES FOR SECURING CASUALTY POWER.

a. The DCA will instruct Main Control to "De-energize and disconnect casualty power from riser or bulkhead terminal."

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b. The switchboard electrician will:

(1) Open the casualty power circuit breaker on the switchboard.

(2) Test to ensure the circuit is de-energized.

(3) Disconnect the casualty power cable from the riser (or bulkhead terminal) leading from the switchboard terminal.

(4) Disconnect the casualty power cable from the switchboard terminal.

(5) Report to Main Control, "Casualty power de-energized and disconnected from riser (or bulkhead terminal) \_\_\_\_\_."

c. Main Control will notify DCC.

d. DCC will direct the repair party to unrig and restow casualty power cables.

e. Procedures for unrigging casualty power cables:

(1) Test each connection block to make sure it is de-energized before removing the cable.

(2) Disconnect cable at the casualty.

(3) Re-connect previously disconnected normal power leads.

(4) Re-energize the load normally.

(4) Disconnect horizontal cable runs.

NOTE: When disconnecting the older style terminals, keep the leads separated between fingers of the rubber glove. When the three leads are free, they shall be dropped to the deck, making sure that no personnel are in the immediate area. The operator shall turn his/her head away from point of contact of cable with deck to avoid injury.

f. After the casualty has been repaired and the casualty power cables have been unrigged, the repair party(s) will notify DCC.



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g. The DCA will inform the Engineer Officer who will then direct the energizing of appropriate power supply circuits. The Engineer Officer will notify the OOD when the casualty has been repaired and the normal power source has been restored.

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## TAB A - CASUALTY POWER BILL

The following pages lay out the various routes to be used when rigging casualty power from designated vital equipment to an available power source. The responsible DC repair station and the terminals and cables to be used are listed. Other routes may be used, but those listed below are the "best case scenario" (the shortest available). In case of damage or other obstruction, the DCA will order an alternate route. The DCRS responsible for rigging casualty power is identified in the column on the right.

NOTE: Casualty power can only provide power from one source to one load, regardless of ABT or MBT at the power panel or controller. On some ships certain important equipment (e.g. HPAC, FOTP) may be on a non-vital circuit where there is no casualty power terminal at the power panel. If this equipment is required and can only be operated on casualty power, then casualty power must be rigged directly into the motor controller. This is a special case requiring additional precautions.

TO 1E SWBD:

<u>FROM</u>	<u>VIA</u>	<u>TO</u>	<u>DCRS</u>
#1 Fire Pump	3-18-1 (35)	RT 3-23-1	III

TO 1SA/1SB SWBD:

<u>FROM</u>	<u>VIA</u>	<u>TO</u>	<u>DCRS</u>
RT 3-23-1	2-23-1 (20)	BT 2-23-3	III

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## TAB B - CASUALTY POWER CHECKLIST

- \_\_\_ Identify damaged cables to vital load.
- \_\_\_ Open power panel breakers to load and tag them out (OOC).
- \_\_\_ Are cables from Normal/Alternate/Emergency power supplies damaged?
- \_\_\_ DCO or DCA recommend to CO the rigging of casualty power.
- \_\_\_ DCA check vital load DC Plate for Norm/Alt/Emergency power supplies and load circuit breaker numbers.
- \_\_\_ DCA order Main Control to open and tag-out load circuit breakers on Norm/Alt/Emergency power supplies.
- \_\_\_ DCO designate source and source riser.
- \_\_\_ DCA designate casualty power route according to Casualty Power Bill.
- \_\_\_ Repair electrician disconnect power feeders from load power panel.
- \_\_\_ Repair personnel rig from load riser to source riser.
- \_\_\_ Rig from load power panel terminal to load riser (install K switch between load power panel and riser).
- \_\_\_ Switchboard watch rig from source riser to source terminal (make sure casualty power breaker is open and de-energized).
- \_\_\_ Bridge passes word "Stand clear of casualty power cables rigged between frames \_\_\_ and \_\_\_" (every 5 minutes).
- \_\_\_ DCA give permission to flash test switchboard watch momentarily energize casualty power breaker.
- \_\_\_ DCA gives permission to energize cables.
- \_\_\_ Repair electrician operationally test the load.

NOTE: if situation exists for more than 24 hours, invoke a temporary standing order.