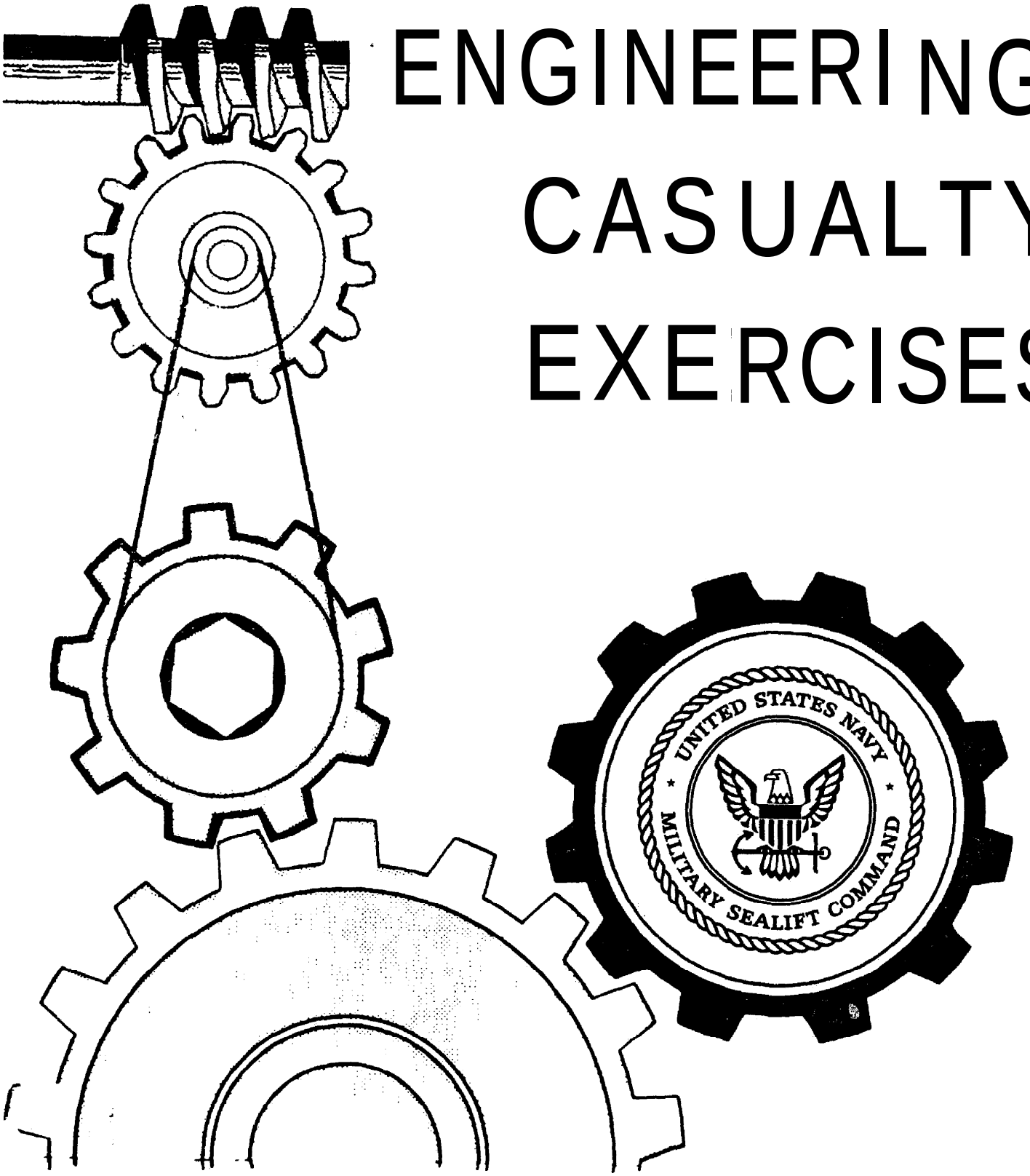
Military Sealift Command
Washington, D.C.
20390-5320

COMSC Instruction 3541.6 A

ENGINEERING CASUALTY EXERCISES



DEPARTMENT OF THE NAVY
COMMANDER MILITARY SEALIFT COMMAND
WASHINGTON. D.C. 20390-5320

REFER TO:
COMSCINST 3541.6A
M-24
MAY 15 1986

COMSC INSTRUCTION 3541.6A

Subj: Engineering Casualty Control Exercises

1. Purpose. To aid the Chief Engineer and engineering officers in conducting shipboard training and *exercises* in engineering casualty control for engine department personnel.

2. Cancellation. COMSCINST 3541.6.

3. Scope. This instruction applies to engineering casualty control in MSC civil service manned ships. It may be used as a guide by MSC contract operated ships.

4. **Background.** Engineering casualty control is concerned with the prevention, minimization and correction of operational failures in machinery, electrical; and piping systems of ships. It is essential that there be planning, preparation and training for casualties so that all hands know their plant and how to handle specific casualties.

5. Action. Chief Engineers shall use this manual as a guide for engineering casualty control training. Since no one set of exercises can apply to all ships in all circumstances, Chief Engineers shall adapt and supplement these exercises as appropriate for their ship's plant, systems and equipment. Blank pages have been added at the end of each section for this purpose. Equipment not covered or unique casualty procedures developed by individual ships, are to be listed on these sheets and retained with the basic instruction. Copies of all such additions are to be forwarded to COMSC code M-24 via the appropriate area commander. Suggestions for improvement of this instruction are encouraged using this same format, **Implementation** of this instruction is to be in accordance with manufacturer's procedures, manuals, and sound engineering practices.

R. F. DONNELLY
Vice Commander

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COMSCINST 3541.6A

MAY 15 1986

LOCATOR CROSS-REFERENCE SHEET

Subj: Engineering Casualty Exercises

See: _____

(Recipient enter information as to where this instruction is maintained)

INTRODUCTION

Engineering Casualty Control is the key to ensuring the safe operation of the engineering plant of your ship. Casualty prevention is the most effective form of casualty control. Casualties do occur, however, either as a result of personnel, machinery, electrical, or piping systems failures. To correct these failures, immediate casualty control action by engine department personnel is required. Quick action minimizes the casualty and maintains control of the ship's engineering plant.

It is necessary to train personnel to have an effective engineering casualty control program. This training familiarizes personnel with the ship's machinery and piping and electrical systems, and with the casualty control action applicable to engineering functions. Casualty control training must be a continuing process during Phase II shipboard training.

In refresher drills, realistic simulation of casualties must be preceded by adequate preparation. The amount of advance preparation required is not always readily apparent. In conducting minor casualties drills, care must be taken to fully visualize possible errors and the consequences which might result from the handling of simulated problems. The simulation of major casualties must be preceded by a thorough analysis and by careful instruction to all participants.

Desire for realistic drills must not detract from sound judgement of the state of training and technical ability of the crew. In the preliminary phases, a so called "dry run" is useful to impart knowledge of casualty control procedures without endangering ship's equipment. In a dry run, a casualty is announced and the affected personnel practice the motions of corrective action. Realistic timing of actions may be made at this time. Dry runs should always be conducted before actually attempting to simulate any involved casualty, regardless of the state of training of the engineering personnel.

Casualty prevention is the maintenance of equipment and machinery by engineering personnel as instructed by manufacturer's manuals, operating instructions and other authorized books and publications. Equally important is the continous alertness of operating personnel.

If an engineering casualty occurs, the watch engineer must take immediate action. If the ship is operating in open water, it is imperative and permissible to secure the affected equipment before serious damage occurs after the bridge and Chief Engineer are notified. When maneuvering in restricted waters, it is essential that continuity of service be maintained. Damaged units must be removed from service and stand-by or alternate units put into operation before searching for the cause of trouble. The safety of the ship may depend upon the engineering personnel's ability to shift rapidly from normal operating condition to an alternate emergency method.

The casualties described in this book are general in nature and it is not possible to cover all casualties. It follows that the causes and symptoms listed for a few of the casualties described are incomplete or only partially listed. Engineers with years of experience will be able to add to casualties shown and Categorical items listed for each of the casualties. The enhanced lists will benefit ship's personnel. Personnel contributing their experience will be recognizing the real purpose of this book, which is to provide a starting point for interest, better training, and further knowledge.

ENGINEERING CASUALTY EXERCISES (AUXILIARIES)

ENGINEERING CASUALTY EXERCISES (FIRE ROOM')

ENGINEERING CASUALTY EXERCISES (DIESELS)

ENGINEERING CASUALTY EXERCISES (ELECTRICAL)

ENGINEERING CASUALTY EXERCISES (ENGINE ROOM)

M-1 INOPERATIVE OR JAMMED MAIN ENGINE THROTTLE (AHEAD-ASTERN)

M-2 LOSS OF/OR LOW LUBRICATING OIL PRESSURE (MAIN PROPULSION ENGINE STEAM)

M-3 LOSS OF VACUUM (MAIN PROPULSION ENGINE STEAM)

M-4 PROPELLER OR SHAFT DAMAGE

M-5 HOT BEARINGS
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M-6 SALT WATER LEAK IN MAIN CONDENSER

M-7 MAIN TURBINE VIBRATIONS

M-8 CASUALTY TO THE DEAERATING FEED TANK

M-9 FIRE IN PROPULSION GENERATOR

M-10 FIRE IN PROPULSION MOTOR

M-11 FIRE IN PROPULSION CONTROL CUBICLES

M-12 LOSS OF ONE PROPULSION GENERATOR
(ONE GENERATOR TWO MOTOR OPERATION)

M-13 VARIABLE PITCH PROPELLER GOES SLOWLY FROM ITS COMMAND POSITION TO "ASTERN'*

ENGINEERING CASUALTY EXERCISES (GAS TURBINE)

G-1 GAS TURBINE ENGINE CRANKS-OVER BUT FAILS TO LIGHT-OFF

G-2 GAS TURBINE ENGINE UNABLE TO START ELECTRICALLY

G-3 GAS TURBINE ENGINE-STARTING ENGINE

G-4 GAS TURBINE ENGINE-OVERSPEEDS

ENGINEERING CASUALTY EXERCISES (MISC.)

AUXILIARY CASUALTY CONTROL

INTRODUCTION

DEPENDABILITY - Dependable operation of shipboard auxiliaries presents the engineer with responsibilities as varied as the equipment itself. This section covers four distinct classes of auxiliary machinery - air compressors, evaporating plants, refrigeration units, and steering gears. Though only the last bears immediately on the maneuverability of the ship, the other three auxiliaries affect the vessel in less direct ways.

The air compressors provide power for all pneumatic valves, pneumatic pump controllers, and, on most ships, to the combustion control system. Though by comparison to other machinery the air compressor is more maintenance free, frequent inspection and recognition of the warning signs will enable the engineer to prevent casualties and preclude the necessity for manual operation of pneumatic systems. It is important to bear in mind that these systems need air that is free of moisture; therefore, all aftercoolers, refrigerated dehydrators, and/or filters must not be neglected.

The distilling plant requires careful attention. If the engineer can maintain proper vacuum and steam heating, most potential evaporator problems can be avoided. Though the evaporators provide potable water for the crew, they also serve the vital function of providing distilled water for the propulsion boilers. Shore water is never sufficiently pure to serve as boiler feedwater. Therefore, the availability of shore water does not lessen the need for the evaporators.

The refrigeration plant is unique in that it does not (even tangentially) affect the performance of the vessel's on-station time. The reality of ships today is that they cannot function without refrigerated stores. Engineers should devote sufficient attention to ensure that the compressors operate properly and that they are able to respond to potential casualties in order to prevent damage to the system components.

Obviously, steering gears are **vital.** Though maintenance merely entails keeping adequate hydraulic oil in the sump and frequent greasing of the gear itself, this program does not. protect against casualties such as ruptured hydraulic piping or electrical malfunction. Correct response requires the engineer to engage manual steering and move quickly to repair the cause. A thorough training program will ensure that each engineer is able to engage, disengage, and operate remote, manual steering.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-1 DISTILLING PLANT CAPACITY OF DISTILLING PLANT REDUCED	SYMPTOMS 1. Distilling unit not delivering its rated capacity. 2. Irregular temperatures and pressures. 3. Irregular water levels. CAUSES 1. low steam pressure to unit or air ejector, 2. Excessive scale deposits on tubes. 3. Air leaks. 4. Feed water temperature low 5. Tube nest drains not functioning properly. 6. Irregular feed water levels. 7. Reduced or loss of vacuum. 8. Erratic operation of Brine Pump.	1. Check steam pressure to unit and air ejector, 2. Check for air leaks in system. 3. Check the scale deposit and clean if excessive. 4. Check feed water temperature and water levels. 5. Check tube nest drains for proper operation. 6. Check out air ejector.	1 Reduction in evaporating fresh water. 2 Possible contamination of fresh water or feed water.

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IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO DE TAKEN	ASSOCIATED CASUALTIES
A-la DISTILLING PLANT CAPACITY OF REVERSE OSMOSIS DISTILLATION UNIT REDUCED	SYMPTOMS 1. Product flow and/or purity are not correct. 2. Decrease in product output with increase in salt passage. 3. Increase in product conductivity. CAUSES 1A. Feed water temperature low and R.O. module is old. B. Cleaning required or not performed properly. c. High R.O. module pressure differential or high salt passage, or low flow with cleaned module. 2A. Fouling of product due to biological growth. B. Low feed pressure to R.O. modules. c. Feed water temperature to high. 3A. R.O. membrane fouling. B. Conductivity indicator Malfunction.	1A&B. Reclean section (special cleaning reagents may be required. Replace module. 2:: Remove foulants by acid cleaning, (Refer to manufactuers guide). B. Check operation of high pressur pump. Adjust pressures to 1st& 2nd stage to proper settings. c. Maintain feed water to manufactures suggested temperature. 3A. Clean membranes as per manufactuers instruction. B. Test and troubleshoot conductivity indicator.	1. Reduction in R.O. units fresh water output. 2. Possible contamination of potable or boiler feed water.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-2 DISTILLING PLANT HIGH SALINITY OF DISTILLATE	SYMPTOM 1. High salinity indicated by electronic salinity indicator. 2. Chemical tests indicate high salinity concentration in distillate. CAUSES 1. Leak in tubes or fittings of unit. 2. Priming due to too high a water level being maintained. 3. Too high or erratic steam pressure to unit, or hunting regulator. 4. Leak in condensate cooler. 5.A. Dirty salinity probe. 5.B. Chemical test equipment dirty (contaminated) giving false reading. 6. S.W. Heater discharge temperature malfunction or incorrectly set.	1. Discharge contaminated distillate into bilge. 2. Check for water level being maintained. 3. Check steam pressure and temperature to unit. 4. Check for leaks in each effect (hydrostatic test). 5. Check salinity probes for contamination on tips. 6. Clean chemical test equipment 7. S.W. Heater discharge regulator adjusted properly/functioning properly.	1. Reduced or loss of evaporation capacity of unit. 2. Contamination of fresh water. 3. Contamination of boiler feed water.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-3 DISTILLING PLANT LOSS OF VACUUM	SYMPTOMS 1. Reduced or loss of vacuum indicated on vacuum gauge. 2. Irregular temperatures noted on effects. 3. Reduced distillate rate. CAUSES 1. Air ejector not operating properly. 2. Air leads in unit and piping. 3. Loss of seal in condensate or brine pumps, pump shaft scored, packing, worn or packing gland loose, etc. 4. Loss of electric driven vacuum pump or loss of water seal in vacuum pump/ tank. 5. Loss of liquid in chemical feed tank.	1. Check out air ejector. 2. Check out for air leaks in unit, packing, and shell/stage drain valves. 3. Check condensate pump and piping for loss of seal. 4. Check vacuum pump and motor. 5. Check piping for loss of seal water. 6. Check water level in seal water tank. 7. Check water in chemical treatment tank.	1. Reduced distillate capacity. 2. Priming and carry-over. 3. Contamination of distillate output.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-4 REFRIGERATION PLANT			
HIGH PRESSURE AT SUCTION SIDE OF COMPRESSOR	SYMPTOMS 1. High pressure indicated on compressor gauge suction side. 2. Knocking noise from compressor. 3. Pressure gauge malfunction. CAUSES 1. Overfeeding of expansion valve. 2. Leaking suction valves or piston rings. 3. Improper functioning of low-pressure control switch 4. Discharge valves leaking. 5. Liquid refrigerant entering compressor.	1. Regulate expansion valve; check thermal element attachment and insulation around bulb. 2. Readjust or replace low pressure control switch. 3. Examine suction and discharge valves and piston rings. Replace if necessary. 4. Replace defective gauges. 5. Defrost with unit secured.	1. Possibility of serious compressor damage if liquid floods back to compressor. 2. Spoiling of refrigerated cargo or stores.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-5 REFRIGERATION PLANT HIGH DISCHARGE HEAD PRESSURE	SYMPTOMS 1. High discharge pressure indicated on compressor gauge, discharge side. 2. Compressor motor stops. 3. High level on receiver gauge. CAUSES 1. Insufficient quantity of cooling water flowing through condenser. 2. Too much refrigerant in system. 3. Malfunction of cooling water regulator. 4. Condenser tubes dirty. 5. Air or non-condensable gas in system.	1. Check condenser and water regulating valve for sufficient cooling water flowing through it. Check condition of condenser tubes, clean if necessary. 2. Check system for it's designed amount of refrigerant in the system 3. Pump down and purge system to remove air or non-condensable gases 4. Set the controls to avoid a vacuum being pulled by the compressor on the system.	1. Possibility of compressor damage. 2. If relief valve lifts, loss of refrigerant. 3. Spoiling of refrigerated cargo.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-6 REFRIGERATION PLAN1			
LOW DISCHARGE HEAD PRESSURE	SYMPTOMS -discharge pressure indicated on compressor gauge, discharge side. 2. Freeze-back to compressor suction side. 3. Compressor motor stops. CAUSES 1. Too much cooling water flowing through condenser. 2. Compressor discharge valves leaking. 3. Expansion valve not functioning properly, causing liquid refrigerant to flood back to compressor from cooling coils. 4. Insufficient refrigerant in system. 5. Leaks in system,	1. Check cooling water volume and its temperature going throu h the condenser, Throttle in3et valve i necessary. Check operation of water regulator valve. 2. Check compressor valves, repair or replace as necessary. 3. Check expansion valve for proper operation and thermal bulb for attachment and insulation, use by-pass, hand control if not functioning properly and replace. 4. Check for sufficient refrigerant in system, add charge if necessary and check for leaks.	1. Possibflity of compressor damage. 2. Spoiling of refrigerated cargo.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-7 REFRIGERATION PLANT COMPRESSOR RUNS CONTINUOUSLY	SYMPTOMS 1. Continuous running of compressor. 2. Reefer box temperatures not coming down. 3. Low head pressure and high suction pressure. CAUSES 1. Shortage of refrigerant in system. 2. Compressor discharge or suction valves leaking badly. 3. Head gasket (blown) leaking between cylinders. 4. Improper functioning of low pressure switch. 5. Relief valve leaking. 6. Compressor overloaded.	1. Check for proper amount of refrigerant in system, add if necessary 2. Test valves; if leaking repair or replace. 3. Replace head gasket. 4. Adjust or replace low pressure switch. 5. Repair relief valve. 6. Check system line up and number of refrigerated spaces to coincid with compressor capacity. 7. Start additional compressor if required.	1. Failure to keep boxes at required temperatures. 2. Spoiling of refrigerated cargo.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-8 REFRIGERATION PLAN1			
HIGH REEFER BOX TEMPERATURES	SYMPTOMS 1. High temperature indicated on reefer box thermometers. CAUSES Automatic thermostatic controls not functioning or are not adjusted properly. 2. Excessive amount of frost on the cooling coils. 3. Re-circulating air flow fan! not operating. 4. Improper storage of stores in the reefer boxes. 5. Expansion valve restricted from moisture in system freezing. 6. Low refrigerant in system. 7. Obstruction at deck level of air flow duct screens. 8. Excessive traffic in and out of boxes. 9. Excessive load on compressor.	1. Check out thermostatic controls for proper operation, repair or replace if necessary use hand by-pass regulation of refrigerant. 2. Check reefer box coils for heavy frost and proper stowage; defrost if necessary. 3. Check expansion valve operation or moisture at valve orifice; adjust or clean. Put dehydrator in operation, if moisture is present. 4. Check re-circulating air flow fans for proper operation; repair or replace if necessary. 5. Check system for proper amount of refrigerant in system; recharge if system is low . 6. Check compressor. (see A-7)	1. Spoiling of refrigerated cargo.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-9 STEERING GEAR FAILURE OF HYDRAULIC TELEMOTOR SYSTEM (LOSS OF STEERING)	SYMPTOMS 1. Ship fails to respond to course changes as initiated by the helm. 2. Rudder angle indicator does not record rudder position changes. 3. Loss of resistance noted with movement of the wheel (helm). CAUSES 1. Relief valve fails to function, causing excessive pressure on system rupturing pipe. 2. Rupture caused by outside force. 3. Failure of piston packing, either in transmitter or receiver unit. 4. Telemotor linkage or pin adrift. 5. No oil in replenishment tank.	1. Shift to electric steering, bridge control if installed. 2. When directed by bridge remove telemotor pin from link controlling steering engine; insert pin or clutch in trick-wheel mechanism. (Local control) 3. If unable to control by above means ready local hand pump for steering, if installed. 4. Reassemble telemotor linkage/ install pin.	1. Loss of steering control on the bridge 2. Loss or reduced maneuverability.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-10 STEERING GEAR RUPTURED HYDRAULIC PIPING TO ONE STEERING RAM (LOSS OF STEERING)	SYMPTOMS 1. Ship fails to respond to course changes as initiated by the helm. 2. Rudder angle indicator does not indicate rudder movement. CAUSES 1. Relief valve fails to function, causing excessive pressure on system, rupturing pipe. 2. Ruptured piping caused by outside force.	1. Secure affected ram. 2. Operate on one ram after securing valve as per instructions posted in steering engine room. 3. Replenish hydraulic oil lost and purge system. 4. Repair or replace relief valve and ruptured piping.	1. Loss of steerage. 2. Loss or reduced maneuverability. 3. Damage to pump or motor.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-11 STEERING GEAR PARTIAL FAILURE OF HYDRAULIC TELEMOTOR SYSTEM	SYMPTOMS 1 Sluggish rudder response. 2: Hydraulic pressure reduced in telemotor system. 3. Unable to get full rudder response. CAUSES 1. Air entrapment in telemotor system. 2. Low oil level in replenishment tank. 3. Leaking by-pass valve. 4. Automatic centering replenishing valve sticking or leaking. 5. Telemotor transmitter and receiver out of synchronization.	**1.** Shift to electric bridge control, if installed. **2.** When directed by bridge remove telemotor pin from link controlling steering engine and insert pin or clutch in trick-wheel mechanism. (Local control) **3.** Ready local hand pump for steering, if installed. **4.** Fill replenishing tank and purge system. **5.** Check by-pass valve, repair or replace if badly leaking. **6.** Check operation of centering replenishing valve; free up; repair as necessary.	1. Loss of steerage. **2.** Loss or reduced maneuverability.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-12 STEERING GEAR FAILURE OF ELECTRO HYDRAULIC TRANSMITTER OR RECEIVER	SYMPTOMS 1. Ship fails to respond to course changes as initiated by the helm. 2. Rudder angle indicator does not indicate rudder movement. CAUSES 1. Power failure to transmitter or receiver. 2. Open in (helm) transmitter unit or receiver wiring.	1. Switch to other mode of bridge steering. 2. When directed by bridge, shift selector switches in after steering station to after steering and take control. 3. Check out power and control circuits in transmitter. Repair as necessary.	1. Loss of steerage. 2. Loss or reduced maneuverability.

IN CASE OF **CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER**

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-13 STEERING GEAR FAILURE OF ELECTRIC STEERING MOTOR	SYMPTOMS 1. Ship fails to respond to course changes as indicated by the helm. 2. Rudder angle indicator does not indicate rudder movement. 3. Motor overload alarms. 4. Switchboard feeder circuit breaker "OPEN" alarms. CAUSES 1. Power failure to motor. 2. Open or short circuit in motor windings. 3. Failure of electric control circuits. 4. Failure of motor controller	1. Switch over to standby pump and motor from bridge if provided. If not, switch over at steering compartment when directed by bridge. 2. Switch power feeders to alternate source. 3. If unable to restore power, use hand pump to steer or position rudder. 4. Untwin screw ships, heading may be controlled by maneuvering of engines at sea. 5. Rudder quadrant may be controlled with emergency tackle if facilities are provided. 6. Check motor and steering unit electric controllers.	1. Loss of steerage. 2. Loss or reduced maneuverability.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-13A STEERING GEAR (STEAM) FAILURE OF STEAM STEERING ENGINE	SYMPTOMS 1. Ship fails to respond to course changes as indicated by the helm, 2. Rudder angle indicator does not indicate any rudder movement. CAUSES 1. Condensate build up in system. 2. Failure of steam supply regulator or inadvertant closing of steam supply or exhaust valves. 3. Bent, broken or seized control valve or stem. 4. Blown packing and gland. 5. Broken piston ring. 6. Hal function of follow-up gear. 7. Entry of foreign particles in system. 8. Control piston or slide valve linkage out of adjustment. 9. Seized connecting rod or main bearing.	1. Verify adequate steam supply, drain steam supply line and cylinders. 2. Shift to stand-by steering engine after warming up. 3. Secure inoperative steering engine and repair. 4. Check system contamination. 5. Reset linkage for control piston or slide valve. 6. Take clearances replace or scrap and fit bearings. 7. Clean oiling equipment passages and lubricate.	1. Loss of steerage. 2. Loss of maneuverability.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-14 AIR COMPRESSOR, SHIP'S SERVICE LOSS OF AIR PRESSURE AND/OR REDUCED CAPACITY OF COMPRESSOR	SYMPTOMS 1. Low air pressure alarm rings, if installed. 2. Excessive pressure drop indicated on receiver tank pressure gauge. CAUSES 1. Failure of compressor prime mover. 2. Restricted (dirty) air intake filters, ruptured or plugged (restricted) inter- or after-coolers. 3. Failure of pressure controller device and unloader. 4. Relief valve leaking, rupture in piping system and/or air volume demand greater than compressor capacity. 5. Dirty or broken compressor air valves or piston rings, 6. "V" belt drive slippage or breakage.	1. Secure non-essential air services. 2. Start up and put into service the stand-by air compressor; if installed. Follow manufacturer's instruction for starting idle compressor. 3. Check out the prime mover of affected unit. 4. Check "V" belt adjust tension or replace if necessary. 5. Check the condition of the intake filters; if dirty, clean. 6. Check the operation and settings o the pressure controller device and unloader. 7. Check coolers for leaks or restriction; repair or clean if necessary. 8. Check piping, relief valve, etc. for leaks or ruptures and correct same. 9. Check compressor air valves; clean or replace if dirty or broken. 10. Check piston rings, replace as required.	1. Loss or reduced air. 2. Loss of air operated control systems.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-14A AIR COMPRESSOR ABNORMAL COMPRESSOR OPERATING TEMPERATURE	SYMPTOMS 1. Smell of hot oil in area of compressor. 2. Excessive temperature and pressure rise indicated on compressor and thermometers 3. Inter-cooler relief valve blowing off. 4. Reduced oil pressure. 5. Shutdown by high air temperature switch. CAUSES 1. Loss of. or insufficient cooling-water (water cooled). 2. Fins of inter and after cooler dirty and/or cooling fan inoperative (air cooled). 3. Dirty and/or broken compressor intake and discharge valves. 4. Insufficient lubrication. 5. Unloader or signal control fails to stop compressor from pumping air, andcreate an over pressure condition.	1. Secure affected unit immediately. 2. Start up and put into service the standby air compressor; if installed. Follow manufacturer's instructions for starting idle compressors. 3. Check cooling water to unit. Clean coolers and water jackets if restricted. 4. Check cooler for air leaks, plug if leaking. 5. Clean fins on coolers of air-cooled units, check fan for operation, correct same if inoperative. 6. Check compressor air valves (intake and discharge) for leaky condition or broken. Clean or replace as necessary. 7. Check oil pressure and level. 8. Check unloaders and pressure switch control for proper operatior and settings.	1. Reduced or loss of air capacity. 2. Danger of explosion or fire if allowed to continue under high temperature conditions. 3. Loss of air operated control systems.

IN CASE OF CASUALTY OR **FIRE NOTIFY** BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
A-15 SALT WATER SERVICE PUHP LOSS OF SANITARY WATER PRESSURE AND/OR SALT-WATER SERVICE PRESSURE	**SYMPTOMS** 1. Sanitary saltwater service pressure gauge reads low. 2. Air compressor stops, high cooling water temperature. 3. Refrigeration compressor stops, high discharge pressure and condenser cooling water temperature. 4. Loss of cooling water to spring bearings and stern tube. 5. Loss of cooling water to main feed pumps and other auxiliary machinery, 6. No flushing water in heads. CAUSES 1. Failure of motor driving pump. 2. Failure of pump end. 3. Restriction in suction or discharge piping system. Ruptured piping. 4. Flushing water to heads demand more water than capacity of pump. (Flushometer valves stuck open). 5. Failure of pressure cut in/ cut out switch.	1. Put standby sanitary or saltwater service pump into service. 2. Crossover fire main if necessary. 3. Check suction and discharge strainers and ensure there are no ruptured pipes. 4. Check flushometer valves in heads. 5. Check cooling water to: (a) Air compressors. (b) Refrigeration condensers. (c) Main feed pumps. (d) Spring bearings and stern tubes. (e) Steam return condenser. (f) Ships serivce generators. (g) Other auxiliary machinery.	1. Loss of the use of air compressors. 2. Loss of cooling water to refrigeration condensers causes compressor to stop. 3. Loss of cooling water to spring bearing and stern tube components. 4. Loss of cooling water to feed pumps. Damage to boilers. 5. Loss of plant.

FIRE ROOM CASUALTY CONTROL

INTRODUCTION

BOILER OPERATION - Successful boiler operation demands that care be given to two primary functions - maintenance of proper water level in the boiler and correct operation of the burners in order to retain proper steam drum pressure at variable rates of steam flow.

The engineer's overriding concern, though it is not unique to the fire room, is of special consequence here; that concern is SAFETY. With ship's propulsion boilers operating at 450 psi and up, SAFETY is paramount. The water level must be properly maintained. If too low, circulation is interrupted and boiler tubes will fail; if too high, the water may carry-over and the turbines may sustain major damage. Similarly, the boiler must be kept at proper steaming pressure to be able to respond to all commands. Though the safety valves prevent drum pressure from exceeding design limitations, the sacrifice for over-firing is lost feedwater, inefficiency, and perhaps renewal of the safety valves if frequent lifting causes their seats to become scored. In contrast, failure to reach proper drum pressure precludes efficient, full-power operation and jeopardizes response time in the event of emergency speed changes. Of course, improper burner management creates further hazards to both personnel and boilers by increasing the likelihood of causing explosions, flare backs, up-take fires or refractory and tube corrosion.

The bottom line is that all water or fuel casualties in the boiler room must be responded to quickly, with a view towards SAFETY FIRST. Protection of personnel and boilers is the engineer's primary concern; maintenance and restoration of normal operating conditions follow closely, but at a respectful distance behind.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-1 FIRE ROOM LOSS OF FUEL OIL PRESSURE	SYMPTOMS 1. F. 0. pressure gauge not registering pressure. 2. Burner fires going out. 3. Loss of steam pressure. 4. White smoke. CAUSES 1. Failure of F. 0. service pump. 2. Failure of automatic combustion controls. 3. Restriction in F.O. piping system. 4. Loss of suction to F. 0. pump. 5. F. 0. recirculation valve open. 6. Ruptured fuel piping. 7. Improperly assembled burners. 8. Forced draft fan failure (if interlocks are installed). 9. Quick closing valve maybe tripped.	1. Close burner valves, leave one (1) register open, notify bridge. 2. Shift to manual combustion control and reduce speed to conserve steam. 3. Shift to standby F. 0. pumps. 4. Shift F. 0. suction to another fuel tank. 5. Clean strainers and check valve lineup of the F. 0. system including burner assemblies. 6. Secure boiler steam stops, if necessary, to prevent the total loss of steam pressure. 7. Open superheater vent and drains. 8. Prior to relighting fires ascertain that there is no oil on furnace floor and purging procedures have been carried out in accordance with manufacturer's light off procedures NOTE: Never attempt to relight fires off hot brickwork. 9. Slow down feed pump and partially shut checks to prevent too high a water level which could prevent lighting off again. 0. Start SSDG (if available) if problem persists for more than two minutes.	1. Boiler flare back. 2. Loss of auxiliary and main propulsion power. 3. Damage to turbine due to carry-over

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-2 FIRE ROOM WATER IN FUEL OIL	SYMPTOMS 1. Burners sputtering, fire going out. 2. Loss of steam pressure. 3. Temperature of F. O. fluctuating. 4. Erratic fuel pressure. CAUSES 1. F. O. contaminated with salt water. 2. F. 3. contaminated with fresh water leaking from steam heating coils. 3. Fuel contaminated from supply source.	1. Shift F. O, suction to uncontaminated F. O. tank. 2. Secure burner valves immediately if fires have gone out. 3. Reduce boiler load (conserve steam) Secure boiler stops if necessary and open superheater vent and drains. 4. Clear F. O. of water and when clear relight boilers in accordance with lighting off procedures as posted in fire room strictly adhering to purge time cycle. 5. Start SSDG (if available) if problem cannot be rectified in two minutes.	1. Boiler flare back. 2. Loss of auxiliary and main propulsion power. 3. Slag build up in furnace.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-3 FIRE ROOM			
LOSS OF FEED PUMP SUCTION	SYMPTOMS 1. Feed pump pressure gauge not registering pressure. 2. Feed pump overspeeding and tripping out. 3. Low water level in boiler. 4. High water level in deaerating tank. CAUSES 1. Feed pump failed. 2. Feed pump vapor bound. 3. Deaerating tank empty. 4. Suction valve closed.	1. Slow down to conserve steam. 2. Shift to standby feed pump and shift feed pump suction if necessary. 3. Take action procedures if low water in boiler if water level goes out of sight. Refer to B-4. 4. Check for high temperature of water in the Deaerator tank.	1. Damage to feed pump. 2. Damaged boilers. 3. Loss of auxiliary and main propulsion power.

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IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-4 FIRE ROOM			
LOW WATER IN BOILER (WATER OUT OF SIGHT)	SYMPTOMS 1. Low water level indicated in water glasses or eye-hi level indicator reads very low. CAUSES 1. Feed pump or control failure. 2. Feed water regulator malfunction. 3. Loss of feed pump suction. 4. Tube failure.	1. Secure fuel oil supply to burners. 2. Close feed water check valves and 3. Blow down water level gauge glasses to determine true water level in boiler. 4. Secure blower to boiler and secure stop valves and open superheater vents and drains, remove boiler from line. 5. Relieve boiler pressure by hand releasing gear of boiler safety valves. 6. No attempt should be made to put boiler on line until it has been inspected for damage. 7. Do not attempt to add water until boiler has cooled down.	1. Boiler tube failure. 2. Loss of auxiliary and main propulsion power.

IN CASE OF CASUALTY OR **FIRE NOTIFY BRIDGE** AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-5 FIRE ROOM HIGH WATER IN BOILER (OUT OF SIGHT) **NOTE:** Always assume low water casualty until actual level is determined.	SYMPTOMS 1. Unable to determine level of water or full water glass. 2. Reduced superheat temperature, 3. Carry-over (priming) (moisture) to main and auxiliary steam prime movers, causing them to vibrate and slow down. 4. Possible low level in D. C. heater. CAUSES 1. Excessive feed pump pressure. 2. Defective feed water level regulator.	1. Blow down gauge glass to determine true level. 2. Close feed check to boiler. 3. Open steam supply drains at each steam driven prime mover to prevent carry-over damage. 4. Reduce load of steam driven prime movers to eliminate or reduce carry-over and priming of boiler, lower water level in boiler by means of surface blow. 5. If necessary, remove boiler from line, securing burners, stop, etc., and use surface blow if so fitted, or frequent short bottom blows to lower water level, frequently blowing down gauge level glass to determine true water level in boiler. 6. Follow lighting off procedure when putting boiler back in service. 7. Adjust feed pump pressure regulator. 8. Control water level by manual control until defective feed water level regulator has been repaired. **NOTE:** Take actions, B-4 until actual water level is determined.	1. Serious casualties to steam-driven prime movers. 2. toss or reduced steaming capacity of boiler affected during correction action period. 3. Piping damage or blown gaskets.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-6 FIRE ROOM MAJOR FUEL OIL LEAK	SYMPTOMS 1. Visual evidence. 2. Drop in fuel pressure. CAUSES 1. Rupture in F. O. piping system. 2. Vibrations caused strainer covers to loosen and/or various drain valves to open. 3. Improper change over procedures of fuel strainers and burners 4. Blown gasket.	1. Secure F. O. service pump and suction valve from settler tank, conserve steam. Start SSDG (if available), 2. Alert ship and ready fire fighting equipment. 3. Correct cause of F. O. leak and remove fire hazard. 4. Put Boiler and its associated equipment back in service. 5. Condition may necessitate carrying out the procedure for loss of pressure. 6. Refer to B-l. 7. If fuel leak is localized to one boiler front, secure the quick closing fuel oil valve to the affected boiler and feed stop valv SAFETY & FIRE PREVENTION 8. If oil is on operating deck, throb sand or absorbant (vermiculite) on spill to contain and prevent sliping. 9. Clean up oil-spill prior to refighting off of boiler in vicinity of spill.	1. Loss of main and auxiliary steam equipmemt. 2. Fire or fire hazards present,

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-7 FIRE ROOM FORCED DRAFT BLOWER FAILURE	SYMPTOMS 1. Low or loss of pressure on draft indicator gauge, 2, Excessive black smoke from boilers. 3, Boiler panting. 4. Flame failure if fitted with fuel shutdown interlock. CAUSES 1. Mechanical or electrical failure of prime mover of blower, or blower itself. 2. Derangement to damper or linkage. 3. Failure of automatic combustion controls. 4. Restricted air intake.	1. If two blowers are in operation, speed up blower not affected and open up crossover dampers, if so fitted, reduce steam requirements to meet combustion balance. 2. On systems with only one blower, per boiler and not fitted with crossover dampers , secure effected boiler. 3, Purge boiler light burner using natural draft. See Mfgr. Instructions 4. Reduce load on boilers.	1. Reduced steaming capacity. 2, Boiler flare back.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-8 FIRE ROOM HIGH SALINITY IN BOILER WHILE STEAMING	SYMPTOMS 1. High reading on the electrical conductivity meters or salinty indicators. 2. Testing of boiler water samples. 3. Foaming and priming. 4. Lowered superheater temperature. CAUSES 1. Contamination leakage from: a. Main and/or auxiliary condensers. b. Salt water cooled air ejectors. c. Distilling plants. d. Salt water cooled gland-exhaust condenser. e. Salt water cooled heat exchangers. f. Contaminated drain tank and system. g. Contaminated feed tank	1. Reduce boiler load to prevent priming. 2. Locate source of salinty and correct same. 3. Do not let the water level get below a safe level in the gauge glass. 4. Restore chemical balance within tht boiler. 5. Put boiler on continuous blow. 6. In severe cases take boiler off tht line. 7. Change to alternate feed tank.	1. Severe priming and carryover. 2. Heavy scaling of boiler shell and tubes, resulting in overheating of the boiler tubes. 3. Damage to steam prime movers due to carryover.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-9 FIRE ROOM BOILER EXPLOSION WHILE LIGHTING OFF	SYMPTOMS 1. Explosion. CAUSES -- 1. Improper light off procedures. 2. Insufficient draft. 3. Poor atomization. 4. Inadequate circulation of air between casings. 5. Inadequate purging. 6. Fuel accumulation on furnace floor. 7. Attempting to light off from hot brick work. 8. Lighting off with by-passed safety systems on automated controls.	1. Close quick-closing master fuel-oil valve and each individual burner supply valve. 2. Close feed checks to prevent high water level. 3, Employ fire fighting procedure as necessary. 4, *Insure* that the casing, furnace and fire room are well vented. 5. Do not re-light until extent of damage to boiler has been ascertained and corrected. 6. Do not light-off until cause of explosion has been determined and corrected. 7. Reduce boiler Toad.	1. Grave injury to personnel. 2. Serious damage to boiler, its fittings and accessories. 3. Damage to boiler refractories. 4, Possibility of major fire. 5. Reduction of propulsion and auxiliary power.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-10 FIRE ROOM			
MAJOR FIRE IN FIRE ROOM	SYMPTOMS 1. Visual evidence of smoke and flames or the smell of smoke.	1. Notify bridge. Reduce speed. 2. Secure ventilation in Engine Space. 3. Employ fire fighting procedures and equipment as necessary. 4. If fire is out of control immediately evacuate the space, muster personnel, and proceed as directed by the Chief Engineer. 5. Secure the plant (below at the remote station) make all closures, secure ventilation and release the CO_2 (fixed system). It may be necessary on your ship to remove all and other personnel from below decks - fore & aft of the space the CO_2 is released in. Zone personnel can remain at the fire boundries after OBA men have set up O_2 continuous monitoring fore & aft of the space involved in CO_2 release.	1. Loss of auxiliary and main propulsion power. 2. Loss of vessel.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-11 FIRE ROOM FUEL OIL FIRE (FIRE IN BOILER CASING)	SYMPTOMS 1. Paint blistering on boiler air casing. 2. Smoke emitting from boiler registers and casing. CAUSES making burner. 2. Excessive carbon build-up. 3. Plugged wind box drain. 4. Improper burner adjustment,	1. Secure burners, close registers and stop fuel supply to boiler. 2. Stop forced draft blowers and secure dampers. 3. Turn on steam smothering in boiler casing, if installed. 4. Secure boiler and inspect for possible damage. 5. Utilize CO_2 hose reel or PKP portior of twin agent system as back up to minimize thermal shock to boiler, 6. Water should be used as a last resort. NOTE: Extreme temperature fires may cause steam smothering to disassociate into oxygen and hydrogen, causing a more intense fire.	1. Severe warping of boiler parts. 2. Derangement of boiler. 3. Reduced or loss of steam capacity output.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-12 FIRE ROOM FLAREBACK	SYMPTOMS 1. Explosion. 2. Flame exits from air register openings. CAUSES 1. Temporary interruption of fuel supply. 2. Interruption of air supply or inadequate draft. 3. Unburned combustible gases from any cause, in furnace tube banks, uptakes, or air casings. 4. Failure to use torch when relighting fires, 5. Improper light off procedures.	1. Close quick-closing master oil valve to burner manifold also burner supply valves. 2. Notify Watch Engineer to reduce load. 3. Use fire fighting equipment as necessary. 4. Secure boiler and open superheater vents and drains. 5. Adjust feed check valves or stop feed pumps as necessary to prevent high water. 6. Allow forced draft blowers to burn any oil accumulations from furnace floor. 7. Do not relight until extent of damage has been ascertained and corrected,	1. Oil fire at or near boiler front. 2. Grave injury to personnel. 3. Serious damage to boiler, its fittings and accessories.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-13 FIRE ROOM BRICK OR PLASTIC FALLING OUT OF FURNACE WALL	SYMPTOMS 1. Vibration or panting of the boiler. 2. Overheating of boiler casing. CAUSES 1. Action of slag accumulations. 2. Rapid changes of the furnace temperatures. 3, High sustained furnace temperature. 4. Improper operation of boilers and combustion control, 5. Flareback or explosion. 6. Inadequate dry out procedure after water washing of firesides.	1. If practicable, secure all burner: 2. Notify Watch Engineerto reduceload. 3. If necessary to continue operating the boiler, burners adjacent to the location of the brick or plastic fall-out should be cut out to avoid damage to the boiler casing. 4, Ensure combustibles are not in proximity of overheated areas. 5. Ready fire fighting equipment. 6. When practical, open, inspect and repair using castable refractory.	1. Severe warping of boiler casing and structure. 2. Fire in adjacent areas 3. Reduction of propulsion and auxiliary power.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-14 FIRE ROOM BOILER TUBE OR OTHER PRESSURE PART CARRIES AWAY	SYMPTOMS 1. Hissing noise from the interior or exterior of the boiler. 2. Increased make up feed requirements. 3. Visually seeing steam and water escaping. 4. Higher F. O. pressure required. 5. Increased F. O. combustion. 6. Reduction of boiler chemical concentration. 7. Unable to maintain boiler water level. 8. Extinguishing burner flame. 9. Unable to maintain steam pressure. CAUSES 1. Improper boiler operation. 2. Flame impingement. 3. Fire in tube banks. 4. Low water level. 5. Improper boiler water treatment. (Internal Scaling) 6. Improper fireside maintenance. 7. Improper internal water circulation. 8. Loose tube bank supports. 9. Frozen sliding feet resting expansion. 10. Flareback causing a tube failure. 11. Blocked gas passages causing local overheating.	1. Secure fuel oil to burners and reduce steam demand. 2. Speed up blowers to carry steam up the smokestack. 3. Simultaneously secure boiler stops. 4. Open safety valves by hand to relieve steam pressure. 5. Except when failure was caused by low water or large leak, continue to feed the boiler so as to maintain water level until boiler has cooled. NOTE: Operating boilers have priority for feed water. 6. Secure all air to fireside as soon as pressure has decreased and steam does not escape into fire room. 7. Allow boiler to cool slowly. 8. Open, inspect and repair as required. 9. Open Superheater vents and drains.	1. Reduced or loss of steam supply. 2. Damage to brick and furnace insulation of boiler from steam and water.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
3-15 FIRE ROOM LOSS OF FEED PUMP PRESSURE OR PUMP FAILURE	SYHPTOMS . 1. Feed pump pressure gauge not registering pressure. 2. Low water level in boilers. 3. High water level in deaerating tank. CAUSES 1. Loss of pump suction by: a. D.C. heater or tank empty. b. Vapor or air bound feed pump. c. Overspeed governor on feed pump tripped. d. Pressure regulator governor failure. e. Feed booster pump failure if installed. f. Excessively high feed temperature at D.C. heater. g. Loss of auxilary exhaust pressure. h. Loss of seal in pump. i. Bearing failure in pump	1. Start standby feed pump and put in service. Secure affected pump. 2. Reduce steam consumption demand. 3. If necessary, put emergency auxilary feed pump into service on alternate feed source.' 4. If water goes out of sight in ' boiler gauge glass, put into action casualty control for low water in boiler. Refer to B-4.	1. Casualty to feed pump. 2. Reduced or loss of auxiliary and propulsion power. 3. Casualty to boilers,

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-16 FIRE ROOM FAILURE OF BOILER WATER GAUGE GLASS ASSEMBLY	SYMPTOMS 1. Visual: cracked or broken gauge glass. 2. Dripping of water and hissing of steam escaping fror gauge glass assembly. 3. Ruptured glass. 4. Violent escape of steam. CAUSES 1. Worn gauge glass. 2. Improper installation or assembly of gauge glass. 3. Improper blow down procedures.	1. Use chain operated quick closing valves and secure top and bottom of water column of damaged glass. 2. Open drain on water column of damaged glass. 3. Replace damaged glass following manufacturer's instruction for assembly and installation of gaugr glass. 4. Use other glass for water level indication and maintaining proper water level.	1. Serious injury to personnel close to gauge glass when gauge glass carried away.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-17 FIRE ROOM FAILURE OF COMBUSTION CONTROL SYSTEM	SYMPTOMS 1. Abnormal boiler steam pressure. 2. Abnormal operation of combustion control system. 3. Air pressure or power alarm rings. 4. Black or white smoke indicated. CAUSES 1. Air supply':. a. Inadequate pressure. b. Excess moisture. c. Contaminated air. d. Air leaks. 2. Electrical : a. Loss of power supply. b. Erratic power supply. C. Inoperative electro-mechanical devices. 3. Defective remote sensors or loss of signal to system. 4. Defective Electrical/ Mechanical/Pneumatic components within combustion control system/cabine	1. Shift to manual combustion control 2. Check electrical/air power sources 3, Check input signals. 4. Check output signals. 5. Check operation of devices receiving signals, (feed regulator, damper positioner, fuel pressure regulator, etc.).	1. Reduced or loss of steam pressure. 2. Loss of main propulsion and auxiliary power plant.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-18 FIRE ROOM STACK UP-TAKE FIRE	SYMPTOMS 1. Stack temperature rising rapidly above normal. 2. Uptake casing paint blistering and burning, metal warping and glowing. 3. Sparks coming from stack, CAUSES 1. Poor and incomplete combustion. 2. Accumulation of soot. 3. Insufficient soot blowing and cleaning of tubes and uptakes. 4. Defective soot blowers or improper sequence of blowing tubes, 5. Insufficient draining of steam supply to soot blower	1. Secure F.O. to boiler and close air register and secure forced draft fan dampers, and any openings into casing, Reduce steam demand, 2. Use portable and/or semi-portable PKP fire extinguisher as a last resort to extinguish fire. 3. Use steam smothering to moderate intensity or extinguish fire. NOTE: Use of water to cool hot external surfaces in fire room is acceptable provided that electrical equipment is protected. 4. Ready fire fighting equipment in area and establish fire boundaries. 5. Reduce steam demand and secure feed and steam stops and open superheater vent and drains on boiler, maintain normal water level in boiler. 6. Locate source of fire if not eliminated by previous action. Open nearest boiler or uptake access. By mechanical means break up the carbon which contains the deep seated fire, If necessary use CO_2 or PKP to eliminate surface flames. Stay at maximum range of fire extinguisher being used to prevent thermal shocking and to prevent a dust cloud. 7. Induce CO_2 into the uptake area through the smoke indicator. NOTE: High temperature fire may cause steam smothering to disassociate into oxygen & Hydrogen causing a more intense fire,	1. Reduced steam capacity. 2. Burned out air heater and possible economizers if installed. 3. Potential for major machinery space fire, Refer to B-10

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
B-19 FIRE ROOM FAILURE OF AIR PREHEATER	SYMPTOMS 1. Rotor stops. 2. Loss of lube oil. 3. Increase in stack temperature. 4. FIRE. Refer to B-18 CAUSES 1. Loss of cooling water (Discharge water temperature must not exceed 125°F) 2. Motor failure. 3. Binding due to dirt or foreign object. 4. Loss of lubrication.	1. Engage hand crank and start manual cranking. Keep cooling water and lube oil circulating. 2. Check lube oil pump operation. If pump cannot be started secure boiler and stop preheater rotor when temperature is below 360°F. 3. Check water supply and cooling water control valves. Check all cooling water jackets, rotary joints and heat exchanger. 4. Check electrical problems with motor. 5. Reduce firing rate to avoid high temperatures. 6. Bypass preheater.	1. If rotor is not turned manually when rotor elements are above 360°F fire could start in preheater.

DIESEL ENGINES CASUALTY CONTROL

INTRODUCTION

ENGINE OPERATION - Satisfactory engine operation depends primarily on two items:

1. The presence of an adequate supply of air compressed to a sufficiently high degree, and

2. The injection of the proper amount of fuel at precisely the right time.

Nearly every problem with a diesel engine will be related to these two functions in one way or another. Sufficient compression depends basically on the pistons, piston rings, and valve gear, while the proper injection of fuel obviously depends upon the fuel injectors and activating mechanisms. Such troubles as lack of engine power, uneven operation, excessive vibration, or hard starting can probably be traced to one of these engine functions.

Symptoms will surface if troubles are impending. If, in addition to using their senses, the operating engineers pay close attention to the engine instruments, they will probably be alerted to imminent difficulties. Instrument readings which vary radically from those of normal operation are a clear warning of the need for immediate action.

The engineer must analyze the symptoms carefully; a hit or miss search usually wastes time. A problem can best be isolated by identifying it with one of the engine systems. Once the trouble is associated with a particular system, that system can be traced until the cause is found. Check the most probable cause first and then proceed to the next most probable cause.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-1 DIESEL ENGINE			
UNABLE TO START ENGINE (ELECTRIC STARTING)	SYMPTOMS 1. Engine will not turn over when pressing starter button CAUSES 1. Batteries are low or dead. 2. Poor connection in starter button, batteries or open circuit in system. 3. Starter motor open or badly worn motor brushes. 4. Engine frozen, or water in cylinders. 5. Bendix or engagement solenoid inoperative. 6. Improper grade of oil for low ambient temperatures.	1. Replace or charge batteries. 2. Check starter electrical system for open or poor connections. 3. Check condition of starting motor. 4. Check engine for freeness by jack-over. 5. Repair bendix or engagement solenoid. 6. Change oil to proper grade.	

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-2 DIESEL ENGINE UNABLE TO START ENGINE (AIR STARTING)	SYMPTOMS 1. Engine fails to turn over. CAUSES 1. The pilot valve of the air start control valve is not operating. 2. If the air timing mechanism is a rotary distributor, it may have a scored rotor or a broken rotor sealing spring or stuck slide valves. 3. Starting air is not reachin the air start valves in th cylinder head. 4. Engine is in dead start . position. 5. Jacking gear blocking valv stuck closed. 6. Starting air pressure low. 7. Insufficient oil pressure or stuck reversing servo motors. 8. System improperly lined up	1. Ensure control air supply is lined up. 2. If neccessary, check air start valve to see that it operates freely. 3. Ensure baring gear is disengaged. 4. Bleed air from cylinders, baring the engine to another position, close air cocks and start engine or rock engine with starting air in opposite direction. 5. Air distributor valves should be checked for free movement as part of pre-maneuvering tests.	1. No power. 2. Inability to maneuver.

ENGINEERING CASUAL'	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-3 DIESEL ENGINE UNABLE TO START ENE (PNEUMATIC STARTIN(	SYMPTOMS 1. Engine will not turn over when pressing start button. CAUSES 1. Insufficient starting air. 2. Poor electrical connection in start button circuit to solenoid valve. 3. Air start solenoid valve malfunction 4. Permission functions tied-in to start circuit not met eg. a. Jacking gear still engaged keeping start circuit open. b. Crankcase electric driven exhauster motor not running keeping start circuit open. 5. Loss of power to control panel of engine.	1. Check-out starting air system. 2. Check-out electrical connections for tightness. 3. Check-out electrical connections for tightness, renew coil of solenoid if found inoperative. 4. Disengage jacking gear, start exhauster motor. 5. Check-out source of power to control panel.	

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-4 DIESEL ENGINE LOSS OF STARTING AIR	SYMPTOMS 1. Engine fails to turn over on starting air available. 2, Low air pressure alarm sounds. 3. Engine fails to reverse when reversing gear is actuated. CAUSES 1. Air compressor failure. 2. Air lines or system leaking. 3. Excessive maneuvering or use of air. 4. Defective or stuck open starting air valves.	1. If maneuvering vessel, secure all but one air flask and start all available air compressors. 2. Check air compressor for design volume output. 3. Check for air leaks in system and air starting valve condition. 4. If maneuvering on bridge control, reduce air consumption by shifting to engine room control gear. 5. Keep bridge informed as to condition.	1. Reduced or loss of maneuverability.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-5 DIESEL ENGINE			
ENGINE FAILS TO START WHEN TURNED OVER AT PROPER SPEED	SYMPTOMS 1. Starter turns engine over properly but engine fails to start. CAUSES 1. Fuel supply obstructed. 2. Loss of compression improperly seated intake or exhaust valves. 3. Injectors incorrectly timed 4. Fuel pump not primed or its linkage may be stuck. 5. Automatic shut down devices tripped or activated. 6, Governor defective, giving insufficient fuel charge. 7. Air in fuel lines.	1. Check fuel supply and fuel filter. 2. Ensure fuel is water free. 3. Prime fuel pump and ensure fts linkages are free. 4. Check injection timing. 5. Take compression readings. 6. Check and reset automatic shut dowi devices. 7. Check governor for proper output. 8. Bleed fuel lines to injectors.	1. No power.

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IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-6 DEISEL ENGINE DIESEL-ELECT. PROP. ENGINE SLOWS DOWN	SYMPTOMS 1. Propulsion engine losing RPC gradually. CAUSES 1. Losing control air to bellows in pneumatic/hydraulic governor. 2. Millivolt output signal fron propulsion board to electro-pneumatic pressure transover controlling respective engine not functioning 'properly. 3. Over-exciting propulsion generator. 4. One or more injectors inoperative. 5. Turbo-charger malfunction. 6. Main Motor overloading. 7. Obstructed air intake. 8. Governor and/or controls not functioning properly. 9. Fuel oil pump capacity impaired, 10. Obstructed exhaust system or defective valves. 11. Fouled fuel filters or strainers 12. Running gear components running hot (Stop engine). 13. Defective fuel valve or injector. 14. Turbo chargers or inter-coolers fouled or defective.	1. Reduce speed so as both engines com to idling speed. Notify Bridge. 2. Check-out all air lines, ships service compressed air system, electro-pneumatic transover etc., for air leaks, 3. Check-out electrical output from propulsion board to electro-pneumatic transover. If unable to correct condition transfer engine control from "auto" to "hand" and control engine speed manually at control stand. 4. Check-out excitation circuits from propulsion board to each electric propulsion generator. 5. Check purometer, secure engine, and replace injector(s) with replacemenl injector(s). 6. Check exhaust system to turbo-charge including automatic clutch if instal - ed into turbo-charger, 7. Reduce load(Amperes on main motor).	1. Reduced main shaft RPM 2. Reduced power output of unit affected 3. Reduced maneuverability

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-7 DIESEL ENGINE GOVERNOR FAILURE	SYMPTOMS 1. Engine racing or running away. 2. Engine stops suddenly. 3. Excessive hunting of governor. 4. Governor fafls to respond to Toad changes. CAUSES 1. Low or high oil level in governor. 2. Pilot valve stuck or leaking. 3. Improper adjustment of needle valve. 4. Governor actuating arms binding, loose or separated linkage. 5. Dirty lube oil in governor. 6. Loss of remote control signal. 7. Improper grade or type of oil in governor.	1. If engine starts to overspeed secure engine by emergency stop control. 2. Check governor oil level. 3. Check setting of needle valve. 4. Check pilot valve and actuating linkage. 5. Flush out governor, and refill with proper oil. 6. Check speed drop settings and correct as necessary in accordance to manufacturer's instructions. 7. Restore remote signal. Adjust speed locally until problem is corrected.	1. Excessive engine RAM. 2. Loss of power.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-8 DIESEL ENGINE ENGINE OVERSPEEDS	SYMPTOMS 1. Rapid increase in engine operating speed. 2. Over-speed trips out and stops engine. CAUSES 1. Improper adjustment or governor parts failure. 2. High or low oil level in governor. 3. Fuel pump or injector racks sticking. 4. Throttle linkage loose or binding. 5. Removal of load from engine too rapidly. (heavy seas, general load, etc.). 6. Loss of propeller. 7. Mechanical overspeed device malfunction. 8. Electro-mechanical overspeed device malfunction.	1. Bring engine controller to stop or slow speed, 2. Check governor for parts failure and proper oil level. 3. Check throttle linkage and injector racks for proper freeness, etc 4. Operate engine with proper loads and speeds for condition present. 5. Examine mechanical overspeed spring setting and/or renew parts found worn. Reset to proper setting, 6. Check-out electrical connections. Check-out flexible drive. Remove unit and replace with new.	1. Loss of power of unit affected,

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-9 DIESEL ENGINE STOPS SUDDENLY	SYMPTOMS 1. Will not respond to throttle. 2. Unable to restart engine. CAUSES 1. Obstructed fuel oil supply system. 2. Governor or controls not functioning properly. 3. Air bound or water in fuel oil system. 4. Frozen or seized bearing & shafting. Lube oil failure. 5. Activation of automatic or manual shutdown device. 6. Obstruction of air intake. 7. Damage to pistons, etc. 8. Overspeed trip malfunction. 9. High jacket water temp. switch or low L.O. pressure switch malfunctions causing automatic shutdown.	1. If twin screw, reduce speed of other unit. Do not overload other engine. 2. Correct cause and reset trips 3. Check out fuel oil supply system for obstructions, water, or air bound. 4. Check out governor and control. 5. Jack over unit to see if free. WARNING: Do not open crankcase for any reason until engine is cooled. 6. Check lube oil system. 7. Check overspeed trip and reset or rebuild same. 8. Check out both J.W. Temp & Low L.O. press. switch.	1. Loss of power of unit 2. Reduced or loss of maneuverability.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-10 DIESEL LOSS OF AIR PRESSURE TO AIR CLUTCH	SYMPTOMS 1. Engine over-speeds and trips out. 2. Low air pressure alarm ring 3. Indication of loss of air supply on gauge reading. 4. Odor from clutch slipping (burning). CAUSES 1. Interruption in supply line of air to clutch and assembly. 2. Ruptured air line or clutch tire/boot. 3. Air compressor failure. 4. Faulty logic in automation controls.	1. Bring throttle and clutch control to stop position. 2. Check out air compressor. Refer to: A-14A . 3. Check for rupture in air supply system. 4. Check for obstruction in air supply system. 5. If clutch Is afire, use CO_2, ready fire fighting equipment. 6. Reduce speed of unaffected unit to prevent overloading. 7. Provide portable emergency air supply for emergency maneuvering. 8. Repair faulty systems in automatior controls.	1. Reduced or loss of maneuverability. 2. Fire in engine space.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-11 DIESEL ENGINE			
ELECTRIC POWER FAILURE TO GOVERNOR	SYMPTOMS 1. Engine will slow down to idling speed. 2. Engine will not respond to throttle demand. CAUSES 1. Blown fuses or tripped circuit breaker in control-ler circuit. 2. Power failure to controller circuit. 3. Open circuit in system. 4. Dirty or broken contacts in controller.	1. Check power to controller. 2. Check fuses to controller. 3. Check for open circuit in system. 4. Check controller for broken or dirty contacts. 5. Use manual throttle control until casualty to unit is corrected.	1. Momentary reduced, or loss of, maneuverability.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-12 DIESEL ENGINE			
EXCESSIVE VIBRATION AT OPERATING SPEED	SYMPTOMS 1. Engine vibrates excessively at normal operating speed and steady load. CAUSES 1. Engine foundation bolts are loose. 2. One or more cylinders are misfiring. 3. Propeller is bent or broken or shaft is misaligned. 4. Wiped or excessively worn bearings. 5. Imbalance in turbo charger.	1. Torque down engine foundation bolt! Take deflection readings and check alignment. 2. Ensure each cylinder is firing properly. 3. Operate at reduced speed if necessary until shafting and propeller can be checked. 4. Inspect and take bearing clearance! 5. Inspect turbo for damage or foreigr deposits.	1. Engine structural damage.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-13 DIESEL ENGINE WATER IN ENGINE CYLINDE AND/OR CRANKCASE OR AIR INTAKE PORTS (BOX)	SYMPTOMS 1. Water emitting from test cocks when engine is blown out or jacked over. 2. Water in lube oil. 3, Loss of cooling water, lower level indicated in expansion tank or surge tanl when engine is running. 4. When engine is running, F.W level increases, gas bubble! and vapor escape from F.W. expansion tank vent. 5. High F.W. temperature. 6. Lower firing and cylinder temperatures. 7. Engine cylinder knock, 8. Increase in oil sump level. CAUSES 1. Crack in cylinder head or liner. 2. Leaking or blown out gasket! or seals between combustion chamber and cooling water jacket or exhaust system, 3. Expanded fit tube for injec· tor loose in cylinder head. 4. Bad seal at cylinder lubri- cator quills. 5. Crack in pre-combustion chamber. 6. Expanded fit of injector tul loose in cylinder head. 7. Telescopic tubes leaking serving water cooled pistons,	1. Engine not to be started until cause of leak is determined and corrected, 2. Check cylinders by jacking over with test cocks open, 3. Put pressure test on F.W. cooling system. Conduct visual inspection of unit. 4. Replace part or parts affected. 5. Start lube oil purifier to remove water from lube oil. 6. Replace pre-combustion chamber. 7. Remove loose fitting injector tube and replace with new by expanding and reaming. 8. Check out packing seals at tele- scopic tubing.	1. Loss or reduced power output of unit. 2. Bearing failure. 3. Mechanical internal damage if start up with water in cylinder,

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ENGINEERING CASUALTY	-- INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-14 DIESEL ENGINE LOSS OF FUEL OIL PRESSURE	SYMPTOMS- --Engine slows down and/or stops. 2. Low or no pressure indicated on fuel oil guage. 3. Irregular operation of engine, unable to carry load. 4. Pump failure alarm sounds. CAUSES 1. Low F.O. in service tanks. 2. Restriction in piping. 3. Fuel oil pump failure. 4. Water in fuel oil. 5. Fuel oil filters/strainers dirty. 6. Air entrainment in fuel oil system. 7. Accidental operations of remote fuel/pump shut down. 8. Improperly adjusted or malfunction of relief valve or regulator. 9. Fuel oil pressure regulatin valve (backpressure) malfunctions.	1. Check F.O. level in service tanks. 2. Check valves and piping condition from service tanks to engines. 3. Check condition of F.O. pump, 4. Check F.O. filters and strainers for restrictions. 5. Check for water in F.O. 6. Bleed off air in F.O. booster pump. 7. Check fuel oil pressure regulating valve for broken spring replace wit new spring and reset pressure valve	1. Reduced or loss of power of propulsion.

IN CASE Of CASUALTY OR **FIRE NOTIFY** BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-15 DIESEL ENGINE			
LOW LUBE OIL PRESSURE	SYMPTOMS 1. **Pressure gauge** indicates low lube oil-pressure. 2. L.O. low pressure alarm will ring. 3. Engine noise will increase (bearings, valve gear, etc.). 4. Activation of low oil **pres**sure shut down. CAUSES 1. **Low** lube oil in sump. 2. Restricted lube oil strainers and/or filters and lines. 3. Lube oil pump failure. 4. Broken lube oil line. 5. Pressure regulator faulty. 6. Fuel dilution. 7. High oil temperature.	1. Secure engine **immediately.** 2. Check L.O. level in sump. 3. Check L.O. strainers, filters and lines. 4. Check L.O. pump **capaci**ty. 5. Check pressure regulator. 6. Test for fuel dilution. 7. Correct cause of high oil temperature.	1. Overheating of engine. 2. Burned out **or** seizing of bearings, shaft, pistons, etc. 3. toss of use of unit, 4. Possible crankcase explosion.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-16 DIESEL ENGINE			
LEAK IN LUBE OIL COOLER	SYMPTOMS 1. Engine sump level droppin 2. Test cock on cooler indicates L.O. in cooling water. 3. Lube oil pressure drops. CAUSES 1. Ruptured tube or inner gasket leaking in L.O. cooler.	1. Change to standby cooler or secure engine. 2. Pressure test cooler, plug tube, renew gaskets, or replace cooler.	1. Loss of power of unit while repairing.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-1? DIESEL ENGINE REDUCTION GEAR LUBE OIL PUMP FAILS	SYMPTOMS 1. 1.0. pressure gauges indicate low or loss of pressure. 2. L.O. reduction gear pump alarm rings. 3. Disengagement of pneumatic clutch. CAUSES 1. Power failure to pump motor fuses blown. 2. Open circuit in motor controller or motor. 3. Overload of motor causing overload protection device to drop motor circuit off line. 4. Seizing of motor and/or pumps. 5. Restriction in suction of pump. 6. Broken shaft pump..	1. Stop engine until L.O. pressure is restored, 2. Put standby pump into service. 3. Check power to controller of unit affected. 4. Push reset button and restart pump. 5. Check pump and motor for freeness in turning. 6, Check for opening in circuit. 7. On two engine ship reduce speed until both engines are back on the line.	1. Reduced power and maneuverability of unit affected.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-18 DIESEL ENGINE			
REDUCTION GEAR COOLING WATER PUMP FAILS	SYMPTOMS 1. S.W. cooling pressure gauges indicate low or loss of pressure. 2. S.W. reduction gear low pressure alarm rings. CAUSES 1. Power failure to pump motor; fuses blown. 2. Open circuit in motor controller or motor. 3. Overload of motor causing overload protection device to drop motor circuit off line. 4. Seizing of motor and/or pumps. 5. Broken shaft pump. 6. Restriction in suction of pump.	1. Reduce speed until cooling water is restored. 2. Put standby pump into service. 3. Check power to controller of reduction gear S.W. cooling pump. 4. Push reset button and restart pump. 5. Check pump and motor for freeness in turning. 6. Check for open in circuit. 7. Operate unit not affected at reduced speed until cooling water pressure is restored to affected unit.	1. Reduced and/or loss of power of propulsion unit.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-19 DIESEL ENGINE HIGH FRESH WATER COOLING TEMPERATURE	SYMPTOMS 1. F.W thermometers read high 2. High temperature alarm rings, 3. Low F.W. pressure. 4. Low S.W. pressure. 5. High F.W. level in expansion tank and gas bubbles excaping. CAUSES 1. F.W. or S.W. pump failure. 2. tow level in F.W. system. 3. Air entrainment in either F.W. or S.W. system caused by air leak in suction sid of pumps. 4. Plugged or restricted S.W. or F.W. system. 5. High compression leak into F.W. system from cylinders 6. Overload of engine, 7. Temperature regulator failure or binding.	1. Reduced load and/or speed of engine. 2. C-heck F.W. 1evel and F.W. pump operation. 3. Check temperature regulator, valve by-pass regulator and operate manually. 4. Vent air from system and prime if necessary. Check for air leaks. 5. Check S.W. and F.W. system for obstructions in suction and discharge sides. 6. Check cylinders for cracks or gasket leaks between F.W. side and compression side.	1. Reduced or loss of power output from unit. 2. Overheating of engine.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
D-20 DIESEL ENGINE			
LOW SALT WATER COOLIN PRESSURE	SYMPTOMS 1. Low S.W. pressure indicated on pressure gauge. 2. F.W. cooling water and L.O temperature will rise above normal. CAUSES 1. S.W. pump failure. 2. Sea chest and/or strainer obstructed. 3. Pump air bound. 4. Loss of suction. 5. Leaky Pipe.	1. Reduce load and/or speed of engine, preventing overheating. 2. Cut in emergency S.W. cooling from fire main or alternate source. 3. Check operation and vent S.W. cooling pump. 4. Check and clean S.W. strainer. 5. Steam out sea chest if obstructed.	1. Overheating of engine.

ELECTRICAL SYSTEM CASUALTY CONTROL

INTRODUCTION

SHIPBOARD ELECTRICAL SYSTEM - The shipboard electrical system is a vital, if often neglected, part of the engineering plant. However, with the exception of the turbine or diesel powered generators themselves, the electrical system is largely ignored. This omission can be attributed primarily to the fact the electrical components are largely maintenance free, and secondarily to the fact that many engineers dislike and distrust electricity. Despite this aversion, electrical casualties do occur and must be dealt with rapidly.

The watchword with electricity is SAFETY. Every engineer knows of the dangers, but better judgment is often set aside in times of crisis. Remember to ensure that electrical circuits are de-engergized before doing any work. This check includes not only disconnecting the power source locally, but tripping and tagging the breaker on the main board.

For casualties involving the generator prime movers, consult the appropriate section for exercises with diesels or turbines. The only unique advice is to mark all non-vital circuits on the main distribution board; in that way, if one of two paralleled generators trips out, the non-vital circuits may be tripped before the second generator trips out on overload.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-1 ELECTRICAL ERRATIC OR UNSTABLE FREQUENCY AND VOLTAGE SHIP'S SERVICE SWITCHBOARD/GENERATOR	SYMPTOMS 1. Fluctuating needle of volt meter. 2. Flickering or fluctuating of lights. 3. Hunting of prime mover governor. 4. Varying frequency. CAUSES 1. Voltage regulator not functioning properly. 2. Prime mover governor not functioning properly. 3. Poor commutation. 4. Loose connection. 5. Excessive dirt and oil accumulation in generator. 6. Malfunctioning exciter.	1. Start up stand-by generator and shift electrical load to same, 2. Check-out affected unit: a. Voltage regulator. (When current/voltage fluctuation only exists). b. Governor. (When frequency oscillates). c. Commutation and/or excitation generator d. Loose connections, shorts, or grounds in system. e. Clean generator, regulator, and adjust as necessary, refer to manufacturer'sinstructions.	1. Reduced or loss of electrical power.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-2 ELECTRICAL FIRE BEHIND SHIP'S SERVICE SWITCHBOARD	SYMPTOMS 1. Smell of smoke and burning insulation. 2. Smoke and flames issuing from behind switchboard. CAUSES 1. Shorting out of electrical circuits. 2. Loose connections causing arcing and overheating. 3. Overload on circuits. When circuit breaker fails to function. 4. Dirty switchboard.	1. De-energize circuits affected and isolate section. 2. Shift the load to standby circuits if available. 3. Release and direct CO_2 or Halon at base of flame. (15 lb. bottle or semi-portable hose and reel type CO_2 or Halon). 4. Extreme emergency may require uninterrupted power, in which case leave circuits energized while extinguishing the fire. 5. Use an OBA when fire fighting in a confined space. Electrical fires frequently create toxic fumes.	1. Loss of electrical power on circuits affected. 2. Major fire.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-3 ELECTRICAL OVERSPEEDING OF SHIP'S SERVICE GENERATOR	SYMPTOMS 1. Fluctuating speed of the ship's service generator. 2. Overspeed governor trip, tripping generator prime mover throttle to closed position. CAUSES 1. Defective governor and/or governor control linkage. 2. Sudden decrease load demands of unit in service. (Slow response of governor). 3. Mechanical failure of coupling from engine to generator. 4. Overly sensitive speed control feedback adjustment.	1. Disconnect malfunctioning generator if the situation permits. 2. De-energize non-vital circuits to prevent overload of remaining operating generator. 3. Put standby unit into service and parallel to operating generators. 4. If governor is defective repair prior to putting generator back in service. 5. Thorough inspection of generator and prime mover for overspeed damage. 6. Upon completion of repairs test all safety devices in accordance with regulatory bodies and manufacturer's instructions.	1. Loss of electrical power. 2. Overspeed damage to machine and possible injury to personnel.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-4 ELECTRICAL			
HOT BEARINGS ON SHIP'S SERVICE GENERATOR	SYMPTOMS 1. Bearing temperatures above normal. 2. Bull's eye not showing oil flow. 3. Lube oil pressure gauge indicated low or loss of lube oil pressure. 4. High bearing temperature alarm sounds. CAUSES 1. Lube oil pump failure. 2. Restriction in L. O. system. 3. Insufficient cooling water going through L. O. cooler. 4. Worn or misalignment of bearings. 5. (Ball bearings) Insufficient or overloading of lubricating requirements. 6. Low level in oil pump.	1. Shift load to standby generator. 2. Secure, defective unit, flush out L.O. system and fill with clean oil and clean strainers. 3. Check out L. O. cooler. 4. Check bearing affected for wear and misalignment. Also check oil passages to and within bearing shell to insure they are clear. 5. On greased type bearings, replace bearing and repack with recommended type lubricant. 6. Check flex coupling for dirt and misalignment. 7. Check sump level. 8. Insure that pump puts out sufficient pressure.	1. Dearrangement of shafts and bearings. 2. Loss of electrical power. 3. Bearing failure.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-5 ELECTRICAL SHORT CIRCUIT OR FAULT IN GENERATOR MAIN CIRCUIT BREAKER	SYMPTOMS 1. A brilliant flash (arc) when short circuit arcing fault occurs. 2. Inflammables on fire at or near the area. 3. Odors of smoke and burning insulation. 4. Drop in voltage. 5. Loud noise. CAUSES 1. Defective or dirty circuit breaker. 2. Steam or water leaking on circuit breaker causing short circuit. 3. Breaking down of insulation. 4. Loose connections. 5. Foreign object adrift. 6. Arcing fault with enough energy for destruction but of low current value to preclude breaker tripping.	1. Open circuit breaker secure voltage regulator and trip out prime mover of affected generator. 2. Put standby generator in to service. 3. Have available CO_2 or Halon fire extinguishing equipment. 4. Observe all safety precautions when replacing or repairing circuit breaker. 5. Secure non-vital circuits to avoid overloading remaining operating generator.	1. Loss of electrical power. 2. Class "C" fires. 3. Electrical damage to generator and switchboard.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-6 ELECTRICAL			
LOSS OF POWER TO I.C. SWITCHBOARD	SYMPTOMS 1. Audible sounding of bus- failure alarm. 2. Audible sounding of gyrocompass alarm system. 3. All ground detector lights are out. CAUSES 1. Loss of ship's service power. 2. Power converter fails. 3. Blown power supply fuses and open circuit breakers.	1. Switch to emergency generator switchboard supply. 2. Check power supply from main distribution board. 3. Check power supply fuses and circuit breakers. 4. Check out power converter for proper operation. if applicable. 5. Change to standby M-G set, if available.	1. Loss of ship's service power. 2. Loss of NAVAIDS. 3. Loss of remote instrumentation. 4. Loss of P.A. system.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-7 ELECTRICAL LOSS OF ELECTRIC POWER TO STEERING GEAR (ALSO REFER TO A-13 FOR ADDITIONAL INFORMATION)	SYMPTOMS 1. Sounding of alarm for electrical power failure to steering gear. 2. Rudder and rudder angle indicator will not shift with the movement of the helm (wheel). No rudder action. CAUSES 1. Severance of power cables between steering gear room and engine room. 2. Heavy shock from collision or explosion 3. Power failure due to overload, blowing fuses or tripped out circuit breaker.	1. Helmsman reports to Bridge Watch Officer. 2. Shift to alternate steering motor if power is available. 3. Check circuit breaker on main switch board for proper operation: If tripped reset. 4. Check control panel for electrical power. 5. Check electric power to standby / port steering motor. 6. Shift to alternate supply cable. 7. Rig casualty power (jury rig/ jumper cable). 8. Operate hand operated dual hydraulic pump to hydraulic rams if installed. 9. Rig chain hoists with suitable attachments for rudder positioning. 10. Suggest that the main shaft RPM be reduced until normal steerage has been restored.	1. Loss of steering control.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-8 ELECTRICAL			
FAILURE OF RUDDER ANGLE INDICATOR SYSTEM	SYMPTOMS 1. Rudder angle indicator does not correspond with mechanical angle indicator at helm. CAUSES 1. Blown fuse indicator neon lamp glows. 2. Loss of power at I.C. equipment switchboard. 3. Open-in circuit. 4. Failure of transmitter or indicator. 5. Failure of linkage from rudder to transmitter.	1. Test helm. Observe rudder post action, and or response of ship. 2. Check power supply to system from I.C. switchboard. 3. Check the mechanical operation of the indicator and transmitter systems. 4. Check for open circuit.	1. No remote indication of rudder position.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-9 ELECTRICAL SELF-EXCITED DC GENERATOR FAILS TO EXCITE	SYMPTOMS 1. Generator pilot light does not light up when generator is brought up to speed and excited. 2. Voltmeter does not register a build-up of voltage. CAUSES 1. Open circuits in wiring. 2. Ground in system. 3. Loss of residual magnetism in fields of generator. 4. Unit not up to design speed. 5. Shorted turns in field windings.	A. Generator Fails to Excite and Build Up Voltage 1. Check for loose connection or an open in the the field circuits. 2. Check brush contacts in field circuits. 3. Check position of brushes. 4. Check for high resistance or open circuit in rheostat. 5. Check armature for open or short circuit. 6. Check for proper connection of series and shunt fields in compound-wound generators. 7. Check for residual magnetism in field. 8. Check speed of generator. 9. Check leads from positive and negative brushes. 10. Flash fields of generator with external DC current. (Isolate any electronic controls before flashing fields). B. Generator Builds Up Voltage, But Not to Normal Voltage. 1. Check for low speed. 2. Check switchboard instruments for correct readings. 3. Check for partial shunt field short circuited. 4. Check polarity of one or more field poles. 5. Check correct setting of brushes. 6. Check field circuit for excessive resistance. 7. Check automatic voltage regulator.	1. Loss of available electrical power from unit affected.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-10 ELECTRICAL			
POOR COMMUTATION ON DC MACHINES	SYMPTOMS 1. Sparking at the armature and brush contact points. 2. Arcing and sparking completely around the commutator. 3. Overheating of machine or unit. CAUSES 1. Brushes not seating or spaced properly. 2. Unit or machine needs cleaning. 3. High amount of mica or dirt between commutator bar segments. 4. Short and/or open in the armature coils. 5. Overload on machine. 6. Loose connection(s). 7. Brush rigging not on neutral plane. 8. High resistance connections between riser and armature windings.	1. Check load on machine. 2. Check brushes and commutator; a. Brush tension. b. Spacing of brushes. c. High mica-undercut. d. Dirt between commutator bars. e. Neutral plane of brush rigging. 3. Short or open in armature coils. Check for design resistance. 4. Check for loose connections. 5. Clean machine.	1. Loss of service of machine.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
E-11 ELECTRICAL OVERHEATING OF GENERATORS	SYMPTOMS 1. Generator operating above normal temperature. 2. Thermo readings high; far above normal. 3. High air temperature in enclosed generators. CAUSES 1. Restricted ventilation. 2. Overloaded. 3. Machine not running at design speed. 4. Brushes or brush rigging not set properly. 5. Short in armature. 6. (Water cooled units) Restricted cooling water system. 7. Improper air gap. 8. Loose core laminations.	A. Generator Overheated. 1. Check air passages or ventilation ducts. 2. Check flow of cooling water in water-cooled machines. 3. Check temperature of water inlet in water-cooled machines. B. Field Coils Overheated. 1. Check speed of generators. 2. Check for high voltage. 3. Check brushes for forward and backward lead, DC generators only. (Neutral plane). 4. Check for short circuit in one coil. 5. Check laminations C. Stator of AC Generator of the Armature of DC Generator Overheated. 1. Check on overloading. 2. Check for partial short circuit of one or more coils. 3. Check for short circuits or ground on armature or commutator. 4. Check on air gaps or rotor rubbing the stator. D. Commutator Overheats. 1. Check on overloading. 2. Check brushes for sparking. 3. Check on brush pressure. 4. Brush hardness to be in accordance with specs. 5. Properly seated brushes. 6. Check for high mica or dirt between commatating bars.	1. Loss of electric power and electric-driven auxiliaries.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
G-1 GAS TURBINE ENGINE (CRANKS-OVER BUT FAILS TO LIGHT-OFF)	SYMPTOMS 1. Engine turns over when pressing start button but fails to ignite. CAUSES 1. Ignition malfunction. 2. DC control power loss. 3. Loss of electric driven F.O. booster pump. 4. Accessory drive F.O. pump failure. 5. Governor not functioning. 6. Lack of fuel or fuel system air bound. 7. Loss of proper fuel spray pattern of primary fuel nozzle. 8. Starting batteries are low.	1. Inspect ignition plug, clean and/or renew. Inspect electrical connections. 2. Inspect all electrical connections of control circuits. Check control batteries and put on charge. 3. Inspect both pump and motor for proper operation. Replace unit if required. 4. Inspect accessory drive shaft of F.O. pump. Inspect F.O. pump and replace of required. 5. Examine governor and linkage for proper setting. 6. Check F.O. service tank, check strainers and filters. Purge F.O. system of air. 7. Having insured all other listed causes for turbine not lighting-off have been satisfied then, remove fuel nozzle ring and renew primary nozzle or entire fuel nozzle ring assembly. 8. Recharge or replace starting batteries.	

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
G-2 GAS TURBINE ENGINE UNABLE TO START ELECTRICALLY	SYMPTOMS 1. Engine will not turn over when pressing starter button. CAUSES 1. Batteries are low or dead. 2. Poor connection in starter button or battery terminals. 3. Open circuit in start system. Check the following components that could cause an 'open' in the start circuit. A. Remote 'shut-down' switch. B. Local 'shut-down' switch. C. CO_2 pressure 'shut-down' switch. 4. Poor connections on control panel power circuit. 5. Control-panel circuit fuses not armed or blown. 6. Poor connections on DC starter motor. 7. 'Step-up transformer to starter motor failure. 8. Starter motor open or badly worn brushes. 9. Starter gear frozen. 10. Automatic safety shut-down switches malfunctioned by not resetting to (NC) normally closed: A. Overspeed switch B. High-Exhaust temp. switch C. Low oil pressure switch D. High temp. L.O. switch	1. Recharge or replace batteries. 2. Check starter electrical system for open or poor connections. 3. Check electrical connections on starter button. A. Examine switch for damage & proper electrical connections replace switch if necessary B. --as above-- C. --as above-- 4. Check electrical connections at panel and for open between battery and control panel. 5. Re-arm by pushing fuse module in, thereby arming start-circuit. Replace fuse. 6. Examine transformer connections for tightness. 7. Examine transformer connections for tightness. Replace transformer if defective. 8. Examine starter motor. Replace brushes and reseat. 9. Examine starter gear and free-up. 10. Replace switch after ascertaining which switch malfunctioned.	

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
G-3 GAS TURBINE ENGINE STARTING ENGINE	SYMPTOMS 1. Vibration of engine while coming up to normal operations RPM. CAUSES 1. Bleed-valve inoperative. 2. Fouling of compressor blading.	1. Shut down engine immediately when abnormal (excessive) vibration is noted during the period when engine is coming up to normal operating speed. 2. Examine bleed valve and clean same to prevent binding (sticking). Check out flexible hose from compressor to bleed valve for blockage. 3. Examine air intake plenum for foreign matter and sight into air intake of radial air compressor for foreign matter. Remove same.	1. Loss of unit.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
G-4 GAS TURBINE ENGINE OVERSPEED	SYMPTOMS 1. Overspeed trips out and stops engine. CAUSES 1. Improper adjustment or governor parts failure. 2. Low oil level in governor. 3. Malfunction of overspeed module.	1. Check governor for parts failure or low oil level. 2. Check governor linkage and fuel metering valve linkage for proper freeness. 3. Examine overspeed module for proper operation including flexible drive shaft. Replace if necessary.	1. Loss of power.

MACHINERY SPACE CASUALTY CONTROL

INTRODUCTION

OPERATIONS - The engineer operating the main plant is concerned with two priorities:

1. Maintenance of proper vaccum, and

2. Maintenance of an adequate supply of lube oil.

Proper vacuum is essential for economical turbine operation. It provides both the low heat sink for the thermodynamic cycle and the means by which feed water is recovered and returned to the feed system. Though the condensation of steam is the major cause of the vacuum, the air ejectors establish the initial vacuum and assist in its maintenance during operation. The condensation of steam in turn in assured by an adequate flow of condenser cooling water and by the evacuation of condensate from the condenser. These functions define the parameters which the operating engineer must watch.

The constant supply of lube oil is indispensable to the SAFE OPERATION of the turbine, gears and shafting. Though nearly all vessels have a standby pump which starts automatically upon failure of the lube oil pump on-line, the engineer must be no less vigilant in the event of a failure. Prompt response to a lube oil casualty should enable the engineer to save the turbines and gears by bringing the shaft to a stop. Though speed is of the essence, panic should be avoided; remember that the lube oil gravity tanks give the engineer sufficient time to stop the shaft before the lube oil supply is exhausted.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-1 ENGINE ROOM			
INOPERATIVE OR JAMMED MAIN ENGINE THROTTLE (AHEAD-ASTERN)	SYMPTOMS 1. Throttle valve wheel frozen unable to turn. 2. Throttle valve does not respond to remote controls. CAUSES 1. Valve jammed in open or closed position. 2. Foreign material between bushing and stem of valve. 3. Balance bypass not open. 4. Loss of lube oil pressure. 5. Linkage adrift. 6. Loss of remote control power.	1. Use main line stop valve for throttling. 2. Use astern guarding valve for astern throttle control if astern throttle jammed open. 3. Restore L.O. pressure. 4. Check and repair linkage. 5. Shift to manual control on remote control units. HYDRAULIC CONTROLS 1. Switch to handwheel operation 2. Switch to hand pump and bleeder valve to operate 3. Use mechanical lifters to position throttle valve	1. Reduced or loss of maneuverability. 2. Possible collision or grounding.

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IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-2 ENGINE ROOM LOSS OF/OR LOW LUBRICATING OIL PRESSURE (MAIN PROPULSION ENGINE STEAM)	SYMPTOMS 1. Indication on L.O. pump pressure gauge. 2. No visual evidence of oil passing bull's eye of overflow from gravity tanks. 3. Closing of ahead throttle by action of low L.O. pressure governor. 4. Low L.O. pressure alarm rings. 5. No visual oil flow at bearing sight glass. CAUSES 1. Main L.O. pump failure: a. Mechanical failure of pump or relief valve. b. Power failure to pump prime mover. 2. Restriction in L.O. piping, strainers or pump. 3. Low or empty L.O. sump. 4. Standby L.O. pump fails to start. 5. High oil temperature. 6. Ruptured L.O. line. 7. Improper shifting of strainers.	1. Stop the affected shaft and simultaneously endeavor to regain L.O. pressure. 2. Start up standby L.O. pump. 3. Check L.O. level in sump and shift over strainers. 4. Check L.O. temperature. 5. Inspect bearings, strainers for metal flakes, etc. 6. On gravity feed open standby tank as required. NOTE: Way should be taken off the ship to prevent excessive torque and free wheeling of affected engine.	1. Loss of maneuverability of ship. 2. Damage to bearings, shafting and gears of unit. 3. Damage to prime mover.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-3 ENGINE ROOM			
LOSS OF VACUUM (MAIN PROPULSION ENGINE STEAM)	SYMPTOMS 1. Indication on vacuum gauge. 2. Turbine slowing down. 3. Temperature rise in L.P. exhaust. (Top of condenser) 4. Corresponding loss of vacuum in auxiliary plant if exhausting into main condenser. CAUSES 1. Loss of gland seal. 2. Defect in air ejector. 3. Air leaks from: a. Make up feed system. b. Piping, etc. c. Loop seal. d. Drain tank float valve. e. Vacuum drag to secured evaporator left open. 4. Insufficient cooling water through condensers and air ejectors. 5. Flooded main condenser. 6. Failed condensate pump.	1. Put standby set of air ejectors into service. 2. Throttle in on engine until vacuum is increased. 3. Check gland seal pressure. 4. Check for air leaks: a. Make up feed system. b. Piping, etc. c. Loop seal. d. Drain tank. e. Vacuum drag from evaporator. 5. Check cooling water through condensers and air ejector. 6. Check out for defect in air ejector. 7. Put standby condensate pump on the line. 8. Restore to normal condensate level in main condenser.	1. Loss or reduced power output of main propulsion unit. 2. Low level in D.C. heater. 3. Loss of feed pump pressure.

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IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-4 ENGINE ROOM			
PROPELLER OR SHAFT DAMAGE	SYMPTOMS 1. Vibration of shaft and abnormal noises carried up to engine and reduction gears. 2. Possible heating up of line shaft bearings, stern tube, and main thrust. CAUSES 1. Propeller bent or section broken off. 2. Bent tail shaft. 3. Misalignment of propeller shafting. 4. Shaft bearing bed hold-down bolts loose. 5. Loose, wiped or burned out line shaft bearings. 6. Fouling of propeller or shaft. 7. Loss of lubrication in stern tube bearing.	1. Reduce engine speed to minimize vibrations. 2. Check through the shaft alley to determine causes of the vibrations. 3. If casualty is the shafting or bearings in the shaft alley, effect temporary repairs, conditions permitting. 4. If repairs cannot be effected, operate engine at speeds to minimize vibration. Maintain an alert watch. 5. Clear fouled propeller. 6. Correct lubrication problems in stern tube bearing.	1. Reduced or loss of propulsion power. 2. Damage to adjacent sections of shafting, bearings, reduction gears and/or engine.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-5 ENGINE ROOM HOT BEARINGS A. TURBINE BEARINGS B. REDUCTION GEAR BEARINGS C. LINE SHAFT BEARINGS	SYMPTOMS (A and B) 1. Abnormal temperature of bearings. 2. Failure of lube oil system. 3. High oil temperature to cooler. CAUSES 1. Foreign matter in lube oil and system. 2. Failure of lube oil pump or restriction in system. 3. Excessive wear or misalignment of bearings. 4. Loss of water to L.O. cooler. SYMPTOMS (C) 1. Abnormal temperature rise of bearings. 2. Smell of hot oil. CAUSES 1. Wicks not feeding sufficient lube oil. 2. Oil lubrication rings not rotating (picking up L.O. for lubrication of bearings). 3. Insufficient L.O. in bearing well or/sump. 4. Insufficient cooling water. 5. Flex coupling becomes rigid due to accumulated dirt in coupling.	A and B 1. Reduce engine speed. 2. Check quantity and temperature of oil being fed to bearing. 3. Take samples of lube oil and start up purifier on lube oil system. 4. Operate at such speeds as to avoid abnormal bearing temperatures. 5. Inspect bearing for wear or misalignment when operating conditions permit. 6. Clean and inspect lube oil strainers. 7. Inspect flexible coupling for dirt and wear. C. 1. Reduce shaft speed. 2. Check L.O. level, wick feed and/or oil rings for proper operation. 3. Flush out bearings with clean new oil. 4. Fill bearing well or/sump with the required type oil to the proper level.	1. Reduced or loss of main propulsion power. 2. Damaged bearings. 3. Misalignment.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-6 ENGINE ROOM SALT WATER LEAK IN MAIN CONDENSER	SYMPTOMS 1. High salinty reading on salinty indicator panel for main condensate. 2. Boiler chemical water test indicates high salinty build-up in boiler water and condensate from condenser. CAUSES 1. Overheating of condenser. 2. Split or cracked condenser tube(s). 3. Tubes leaking at tube sheet due to packing failure or in need of re-expanding of tubes. 4. Electrolysis or erosion action of the cooling water causing pin holes, etc., in the tubes.	A. If leak is minor and port arrival is within hours: 1. Pump sawdust through cooling side of condenser to slow down or temporarily stop leak. 2. Keep boilers fresh by blowing down as test indicates need. B. If leak is serious and cannot be controlled with use of sawdust: 1. Secure main engine. 2. Shift all condensate, etc. to auxiliary condenser. 3. Cool main condenser and fill F.W. side with distilled water. Remove condenser heads or inspection plates if large, dry out and inspect for leaks. Plug up leaks with proper type plugs. 4. Prior to filling support condenser by blocking. 5. Bonding straps, zincs, coatings are to be maintained to prevent electrolysis, or erosion damage.	1. Serious scaling up of boilers. 2. Reduced or loss of main propulsion power during temporary repair period. 3. Boiler tube failure.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-7 ENGINE ROOM			
MAIN TURBINE VIBRATION	SYMPTOMS 1. Abnormal vibration of turbine. 2. Turbine slows down. 3. Low vacuum, low superheat temperature, boilers priming, high turbine exhaust temperature. CAUSES 1. Carry over of water with steam from boilers. 2. Damaged propeller or shaft. 3. Distortion of turbine due to uneven expansion. 4. Damaged turbine blading. 5. Deposits from carry-over on blading. 6. Bearing failure. 7. Propeller resonance in shallow water. 8. Dirty or misaligned coupling.	1. Reduce turbine speed. 2. If casualty is due to water carry over, lower water level in boilers to safe operating level and open steam drains. 3. If casualty is due to distortion of rotor, operate at slow speed until even temperature is distributed throughout the turbine. 4. If casualty is due to damaged turbine blading, propeller or shaft, operate unit at such speed to minimize as much vibration as possible until arrival in port. 5. Alter speed to reduce vibration while operating in shallow water. 6. Check and clean coupling. 7. In all cases consult manufacturer's instructions for emergency operation.	1. Reduced or loss of main propulsion power. 2. Damage to bearings, turbine and gears.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-8 ENGINE ROOM CASUALTY TO THE DEAERATING FEED TANK	SYMPTOMS 1. Feed water temperature indicates loss of heat at D.C. tank or excessive heat. 2. D.A. tank water level indicator or sight glass indicates abnormal (high or low) water level. 3. Pipe failure to or from D.C. heater. 4. Loss of feed pump suction. CAUSES 1. Insufficient or excessive auxiliary exhaust steam pressure to maintain proper feed water temperature in D.A. tank. 2. Failure of condensate pump. 3. D.C. heater dump valve open. 4. Ruptured line or blown gasket	1. Admit live steam or shut off into auxiliary exhaust system to maintain proper D.A. tank temperature and pressure. 2. Check auxiliary exhaust back pressure regulation valve. 3. Check relief valve and vacuum breaker on D.A. tank. 4. Secure D.A. tank, by-pass condensate to a reserve feed water tank. Operate at a reduced steaming rate. Feed pump suction from reserve feed water tank. 5. Serious leak in condensate line between condenser and D.A. tank will require securing of a plant for repairs.	1. Reduced steaming capability. 2. Loss of main and auxiliary machinery.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-9 ENGINE ROOM FIRE IN PROPULSION GENERATOR	SYMPTOMS 1. Smoke and/or arcing noted through inspection ports. 2. Generator thermometer indicated excessive high temperature. 3. High temperature alarm sounds. CAUSES 1. Generator coolers not functioning properly, resulting on overheating of unit or leaking of water into generator. 2. Short circuit in generator windings or wiring. 3. Excessive accumulation of oil, dirt or moisture on windings and terminals of generator. 4. Electrical or mechanical overload.	1. Stop unit and de-energize generator. 2. Secure ventilation and coolers to unit and trip Halon or CO_2 fire extinguishing system installed on the machine. 3. Put jacking gear in as soon as possible to prevent warping of the unit. 4. Take necessary action to accomplish temporary repairs to the unit. 5. Maintain propulsion and steerage with unit not affected. 6. Refer to: M-10. 7. Ready additional fire fighting equipment.	1. Loss of propulsion generator. 2. Fire spreading in engine room. 3. Reduced maneuverability.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-10 ENGINE ROOM			
FIRE IN PROPULSION MOTOR	SYMPTOMS 1. Smoke and/or arcing noted through inspection ports. 2. Motor thermometer indicates excessive high temperature. 3. High temperature alarm sounds. CAUSES 1. Motor coolers not functioning properly, resulting in overheating of unit. 2. Short circuit in motor windings or wiring. 3. Excessive accumulation of oil, dirt or moisture in windings and terminals of motor. 4. Electrical overload.	1. Stop unit and de-energize motor. 2. Secure ventilation and cooler to unit and discharge CO_2 or Halon fire extinguishing system, if installed, into the machine/or by removal of covers so provided. 3. Maintain propulsion and steerage with unit not affected if twin screw. 4. Take necessary action to accomplish repairs. 5. Ready additional fire fighting equipment.	1. Loss of propulsion motor. 2. Fire spreading in motor room. 3. Reduced maneuverability

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-11 ENGINE ROOM FIRE IN PROPULSION CONTROL CUBICLES	SYMPTOMS 1. Smell of smoke and burning insulation. 2. Visual smoke and/or arcing in area. CAUSES 1. Short circuit or loose connections in wiring or hook-up of control circuits. 2. Excessive accumulation of dirt, oil or moisture on and about controller electrical wiring, etc.	1. Stop unit and de-energize control circuits. 2. Combat fire with CO_2 or Halon. 3. Make necessary repairs to controller circuit; operate at reduced load until assured that controls and cables operate properly and the insulation tests are in accordance with manufacturer's recommendations. 4. Maintain propulsion and steerage with unit not affected if twin screw. NOTE: Use OBA in a confined space: Electrical insulation and plastic covered cables give off toxic fumes and smoke.	1. Loss of propulsion of unit affected. 2. Reduced maneuverability. 3. Fire spreading in area.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-12 ENGINE ROOM			
LOSS OF ONE PROPULSION GENERATOR (ONE GENERATOR TWO MOTOR OPERATION)	SYMPTOMS 1. Derangement of turbine or generator of fwd or aft engine room. CAUSES 1. Mechanical failure. 2. Electrical failure.	1. Use one generator set up. 2. Set up motor transfer and disconnect switches as per manufacturer's instructions for one generator, two-motor operation. 3. Maintain propulsion and steerage with unit not affected until shift to one generator two-motor operation is put into effect. 4. Take action to make repairs.	1. Reduced power and maneuverability.

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
M-13 VARIABLE PITCH PROPELLER			
PROPELLER GOES SLOWLY FROM ITS COMMAND POSITION TO "ASTERN"	SYMPTOMS Indicated on console either at EOS and/or bridge console. CAUSES 1. Too little control oil pressure or none at all present. 2. No pilot oil pressure present. 3. Control oil temperature is too high.	1. Check control oil pressure. Remedy defect in control pump system. 2. Check pilot oil pressure. If no pilot oil pressure is present, start standby pump and repair as necessary. 3. Check control oil temperature. Remedy defect in control pump or actuating unit. Clean oil cooler if necessary.	1. Loss of ship's speed. 2. Loss of maneuvering capability.

IN CASE OF CASUALTY OR FIRE NOTIFY BRIDGE AND CHIEF ENGINEER

ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
P-1 FLOODED PUMP ROOM BY PETROLEUM PRODUCTS	1. Leaking seals/packing of pumps. 2. Rupture of butterfly type valves. 3. Crack or rupture of expansion joint(s).	1. Secure pump and valves (cease all ops) activate fresh air mask. 2. Ventilate pump room. Prove gas free with portable air driven ventilator unit (COPPU 3 Type). 3. Remove bilge fluid via oil & water separator or to slop tank. 4. Secure all electrical circuitry, lights and power to pump room. 5. Inspect bulkhead packing glands between pump room and other machinery spaces. 6. After gas free atmosphere obtained, effect repairs.	1. Terminate POL Ops. 2. Loss of Product. 3. Fire Hazard.

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
H-1 HYDRAULIC RAM (s) FAILURE TELESCOPIC BOOMS	NOTE: Cellulube has been replaced with a non-toxic fluid 1. Leaking seals.	1. Keep plunger surfaces clean & lubricated.	

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ENGINEERING CASUALTY	INDICATED SYMPTOMS AND/OR CAUSES	ACTION TO BE TAKEN	ASSOCIATED CASUALTIES
S-1 STERN GLAND (SYNTRON TYPE)	SYMPTOMS 1. Uncontrollable leakage, flooding out shaft alley. CAUSES 1. Garter Type spring broke. 2. Sealing ring joint failed.	1. Reduce speed and/or stop main propulsion shaft. 2. Notify bridge. 3. Immediately convey de-watering pumps/eductors to shaft alley to control flooding, thereby allowing ship to remain underway if casualty occurredin close channels. When permitted to affect repairs proceed as follows: 1. Lock propulsion shaft to prevent from turning. 2. Pressurize inflatable seal and maintain pressure. 3. Disassemble (syntron-type) housing assembly and renew one (1) or both seal rings. Reassemble and deflate inflatable seal and unlock shaft. NOTE: If spare seals are not onboard use flax-type packing in lieu of seal rings. Refer to MFR's Tech. Manual.	1. Loss of propulsion.