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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

WALTER C. RIGSBY, JOSEPH K. KLOSE and SHELDON H. MANNING,

Plaintiffs,

vs.

JOHNS-MANVILLE, etc., et al.,

Defendants.

No. C 151 947

EXHIBIT III

EXHIBITS TO THE DEPOSITION OF SHELDON H. MANNING, VOLUME VI, taken Tuesday, March 6, 1979, at Los Angeles, California, before Lucia Moskal, CSR, a Notary Public.

2 OF 3 B

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Reported by:
Lucia Moskal, CSR 1222

No. LA-788-79

MT-PWHD-005286

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7. **Adjusting Parts.** Do not tighten a nut, bolt, or pipe thread, nor strike any part, nor attempt to make any other adjustments to parts while the boiler is under steam or air pressure.

8. **Foreign Substances.** Exercise precautions to prevent lubricating oil, soap, or other foreign substances from getting into the boiler. Condensate from cleaning vats should be led to waste and not returned to the boiler.

9. **Closing Furnace.** Close the furnace openings as soon as all fires have been extinguished and the furnace has been cleared of gases.

10. **Unattended Boilers.** Where unattended boilers are in operation, boiler room doors should be provided with locks and kept locked during periods of nonattendance.

11. **Valve Pull Chains.** In shore installations the handles on pull chains to boiler water-gage cocks and water-gage glass stop valves shall be painted the following colors:

Opening water-gage glass stop valves	White
Closing water-gage glass stop valves	Red
Top gage cock	Yellow
Center gage cock	Green
Bottom gage cock	Blue

In the event of a broken gage glass the boiler operator will pull the chain or chains having red pull handles and shut off the flow of steam and hot water.

0727. FIRE PREVENTION

Detailed measures for the prevention and extinguishment of oil fires can be found in article 2015. In addition, the following precautions are emphasized:

1. Keep the joints on oil lines tight.

2. Do not permit oil to accumulate on the furnace bottoms or on fire-room floors.

3. Soot blowers shall be used as frequently as necessary to keep boiler surfaces which are exposed to fire and gases clean.

4. When fires are banked, make certain the draft is sufficient to carry off flammable gas accumulations.

5. Do not use water to extinguish an oil fire in the furnace.

6. In case of an oil fire in the boiler room, close the master fuel-oil valve and stop the oil pump.

MARINE BOILERS

0730. SHORE ACTIVITY SERVICED

Any work done on shipboard boilers by shore activity personnel shall be conducted in accordance with the safety precautions contained in NAVSHIPS 250-000, Bureau of Ships Technical Manual.

AIR RECEIVERS AND COMPRESSORS

(UNFIRED PRESSURE VESSELS)

0735. GENERAL REQUIREMENTS

1. **Design and Construction.** Unfired pressure vessels shall be designed in accordance with applicable codes of the American Society of Mechanical Engineers, the National Bureau of Standards, or Bureau of Yards and Docks Instruction 11012.67, *High Pressure Air Systems; Design Criteria No. 35*. When departure from these codes or criteria is considered essential, requests for changes shall be referred to the Bureau of Yards and docks with copies to cognizant technical and support bureaus and offices.

2. **Inspection and Testing**

a. **Fixed Systems.** Inspection and testing of unfired pressure vessels shall be accomplished in accordance with NAVDOCKS

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MT-PWHD-005287

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P-322, *Inspection for Maintenance of Public Works and Public Utilities.*

b. Portable Equipment and Cylinders. Cylinders used for shipment of compressed or liquefied gases shall be inspected in accordance with regulations of the Interstate Commerce Commission (see article 2044). Although portable compressors, receivers, and other unfired pressure vessels having a volume less than 5 cubic feet are not specifically covered in *NAVDOCKS P-322*, such equipment shall be inspected and tested in accordance with the applicable principles of *NAVDOCKS P-322*, ASME codes, or the handbook of the particular item of equipment involved. Personnel trained and acquainted with the procedures and techniques of inspecting and testing unfired pressure vessels shall be utilized.

3. **Torpedo Airflasks.** Torpedo airflasks, although not designed in accordance with accepted standards (see paragraph 0730.1), are in use in fixed and portable systems throughout the Navy. The risks accepted in using these airflasks for combat purposes are not acceptable when they are used for other purposes. When they are used in fixed and portable systems in the Shore Establishment, working pressures and installation shall be modified in conformance with ASME standards, and inspection and testing shall be in accordance with instructions contained in *Ordnance Pamphlet 1806, High Pressure Air Systems Ashore – Design and Operation.*

0736. AIR RECEIVERS (COMPRESSED AIR TANKS)

1. **Operating Pressure.** Do not operate an air receiver at a pressure higher than the maximum allowable working pressure unless such operation has been specifically authorized.

2. **Unauthorized Use of Compressed Air.** Do not use compressed air to accelerate the flow from containers of oil, gasoline, or other fluids. This practice is dangerous to the operator and fellow workers and is prohibited.

3. **Cleaning and Repairing**

a. Never attempt to make repairs of any nature while the air receiver is under pressure.

b. Carefully observe precautions for cleaning air receivers. When air receivers are of sufficient size to admit a man through a manhole opening, the manhole covers should be completely removed. Adequate ventilation must be provided, and there must be no oxygen deficiency, no volatile gases, and no carbon monoxide present in dangerous quantities.

4. **Condensate.** The condensate blow socks should be open daily when the receiver is in use and all condensate drained and observed for the possible presence of oil.

0737. AIR COMPRESSORS

1. **General Care**

a. Be sure the air at intake is cool and free from flammable gases, vapors, or dusts.

b. Do not permit wood or other flammable materials to remain in contact with the air discharge pipe.

c. Immediately secure a compressor if the temperature of the air discharged from any stage rises unduly or exceeds 400° F.

d. Do not install a stop valve or check between the compressor and receiver unless a relief valve is also fitted between the compressor and the stop or check valve. (If the compressor is started against a closed valve or a defective check valve the air cannot escape and an explosion will result.)

e. Pressure gages shall never be rendered inoperative except when they are to be removed for some valid reason.

f. Never kink a hose to stop the air flow. Keep the clamps on the hose tight.

2. **Starting and Running**

a. When starting an air compressor check the safety valves, pressure valves, and regulators to determine that they are working properly.

b. Do not leave the compressor station after starting the compressor unless it has been made certain that the control, unloading, and governing devices are working properly.

c. Do not run an air compressor faster than the speed recommended by the manufacturer.

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LBNS SAFETY SUPPLEMENT NO. 0737

Subj: Compressed Air Systems

1. GENERAL. It has been established that there is constant danger in the production and use of compressed air. Some of the inherent dangers when using either fixed or portable systems are explosions due to oil in the systems; rupturing of vessels, lines and/or fixtures; improper mounting, maintenance, inspection and operation; and contamination when the air is used for breathing.

2. POLICY. Only competently instructed, fully qualified and properly trained personnel will be assigned to the installation, hookup, operation, inspection and maintenance of such equipments.

a. Portable high pressure compressors, over 150 pounds per square inch. Hookup will be made by Shop 56 employees and the compressor will be operated only by Shop 38 employees. Inspection, maintenance and test will be accomplished by Shop 06.

b. Fixed High Pressure Compressors, over 150 pounds per square inch. The compressor will be operated only by authorized employees of the cognizant shop. Inspection, maintenance and test will be accomplished by Shop 06.

c. Compressed Air Systems less than 150 pounds per square inch. With the exception of the Shipyard compressed air system and USN numbered air compressors (maintained by PQME Department), all fixed and portable compressors will be maintained by Shop 06 employees and operated by the cognizant shop.

3. PROCEDURES FOR HIGH PRESSURE AIR SYSTEMS

a. Installation (Hookup)

(1) Only high pressure hose, tubing or pipe will be used as the discharge line. The line fittings must be certified safe for at least 1-1/2 times the maximum capacity of the compressor.

(2) The discharge hose, tubing or pipe must be as short and direct as possible.

(3) A shut-off valve will be installed between the compressor discharge and the air receiver storage, and also between the air receiver storage and the point at which the air is used. A relief valve must be fitted between the compressor and any stop or check valves.

(4) All receivers shall have pressure gauges with proper scale to indicate receiver pressure. Scale should be chosen so that normal operating pressure is roughly in middle of gauge scale.

MT-PWHD-005289

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(5) All tubing and connections will be closely inspected for hardness and crystalization, and if necessary, replaced or annealed each time used.

(6) Pressure gauges or safety valves will never be rendered inoperative except when they are to be removed for some valid reason and only then when the equipment is not in operation.

(7) Portable or temporary charging connections are to be arranged so that all air remaining in a charged line or fittings can be bled down safely before the connection is broken.

(8) All portable or temporary charging connections are to be "backed up" by adequate safety straps or chains so that sudden uncoupling or rupture, while under pressure, will not allow the charging line to jump or whip dangerously.

(9) The compressor must set as close as possible to within 5° of level to permit adequate lubrication.

(10) Valving shall include shut off valves before and after pressure reducing or regulating valve. A valved by-pass shall normally be furnished, as well as a pressure gauge on both sides of the reducing station, upstream and downstream of the shut off valves.

(11) All compressed air distribution lines shall be properly sloped and trapped. Automatic traps shall be used when possible, with manual blow down for checking, on all larger systems.

b. Operation

(1) Every effort will be made to insure that only clean, cool dry air is received by the compressor. The intake will be free from flammable gasses, vapors and dust.

(2) Flammable materials will not be permitted to come in contact with the air discharge pipe.

(3) The compressor will never be operated without the cooler shroud and fan in place. Do not permit the air flow to the cooler tube to become obstructed.

(4) If the temperature of air discharge rises unduly or exceeds 300°F, the compressor will be secured immediately and the cause of such temperature rise corrected. Inner coolers and after coolers should be utilized when practical to keep air temperatures at reasonable levels.

(5) Examine all pressure lines for leaks and correct. Inspect for undue vibration, examine all connections and parts for crystalization

MT-PWHD-005290

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J-M 83

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where excessive vibration is found. Secure the equipment and correct if necessary.

(6) An air receiver will not be operated at a pressure higher than the maximum allowable working pressure unless such operation has been specifically authorized by the head of the cognizant shop.

(7) To prevent accumulation of moisture in the crank, cold machines should always be operated for at least five minutes after a stabilizing operating temperature is reached. A stabilizing operating temperature is usually reached after approximately ten minutes of operation at normal temperature.

(8) Only approved uncontaminated high flash point oil shall be used.

c. Precautions

(1) After starting the compressor it shall not be left unattended without previously ascertaining that control, unloading and governing devices are working properly. This precaution is especially important when starting a new compressor or one that has not been used for some time.

(2) High pressure air valves will not be opened rapidly.

(3) The hose will never be kinked to stop the air flow.

(4) Drain all condensates hourly.

(5) Check the oil level daily.

(6) Always leave pressure gauges open to the spaces to which they are attached in order to avoid accidents which have occurred due to disconnecting parts of a system while under pressure. Prior to working on, loosening or removing parts, fittings, etc., of the system to the compressor, the following conditions shall be ascertained:

(a) The compressor is actually secured and cannot be started automatically or accidentally.

(b) All pressure is completely released.

(c) All valves between the compressor and receiver are closed, including the control or unloading valves.

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4. RECEIVERS (AIR BACKS, ACCUMULATORS AND FLASKS).

a. Design and construction. Unfired pressure vessels will be designed in accordance with applicable codes of the American Society of Mechanical Engineers, the National Bureau of Standards, or BUDOCKSINST 11012.67 (High Pressure Air Systems, Design Criterial No. 35). When departure from these codes or criteria is considered essential, requests for changes will be referred to the Navy Facilities Engineering Command.

b. Precautions

(1) Receivers will never be charged to more than 100 pounds above prescribed working pressure.

(2) Any cutting of air flasks, accumulator or other receiver receptacles for compressed air is prohibited.

c. Air flasks will not be:

(1) Transported or hoisted from one deck to another, etc., in a fully charged condition except when it is not possible to perform the operation efficiently and expeditiously with the air flasks partially charged.

(2) Artificially cooled by use of water during charging or after charging.

(3) In general, anything other than lubricated plug valves or air cocks of appropriate pressure rating shall not be used in compressed air systems.

5. ELIMINATION OF OIL CONTAMINATION WHEN CHARGING FROM SHORE. NAVSHIPSINST 9490.5 provides information for charging high pressure air systems 3,000 psi or greater from the shore, and states that all shore based charging will be from a clean oil-free source via the ship-installed dehydrator, where provided. To provide clean oil-free air:

a. Thoroughly check the shore supply system and blow down as follows:

(1) Blow down compressor inter and after coolers and separators, piping system mechanical separators, air receivers, low point drains and discharge nozzles.

(2) A filter suitable for oil removal should be installed in the compressor discharge or at the dockside supply station. If the filter is already provided, fresh elements should be used.

MT-PWHD-005292

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J-M 83

b. If a ship dehydrator is installed, check the condition of the desiccant before and after charging, and replace if necessary.

6. INSPECTION

a. Inspection and testing of unfired pressure vessels will be accomplished in accordance with NAVDOCKS P-322, Inspection for Maintenance of Public Works and Public Utilities.

b. All compressed air systems will be inspected for oil contamination at overhaul periods or when oil contamination is suspected. When inspection indicates the presence of lubricating oil in the piping or components in amounts more than a light film coating, the system will be cleaned. A light film coating is that obtained when an oil coated surface is wiped off thoroughly with a rag. The inspection will consist of the following:

(1) Collect and examine blowdown from all air flasks, separators, low point drains, etc., and disassemble selected piping sections and components downstream of the compressor discharge. Blowdown will be accomplished by cracking the drain valve slowly and blowing to a clean container until air begins to escape. Allow content to settle and examine collected liquid for oil content.

(2) Selection of representative sections of piping and components for disassembly and inspection will include sections of piping at the compressor discharge and in low points or pockets most likely to collect lubricating oil. If such locations are free of oil, it may be assumed that the remainder of the system is oil free.

7. BREATHING AIR

a. Where air is to be used for breathing purposes, the system shall be equipped with temperature control alarms and carbon-monoxide indicator alarms. Air will be sampled for purity periodically in accordance with NAVFAC Instruction 11300.24.

b. The Industrial Hygienist (Code 730) will take samples of Shipyard breathing air at a minimum of six different well separated locations at least once per quarter. The samples will be analyzed and compared with air purity standards and the results of the analysis will be reported to the Safety Division. If the samples fail to meet established standards, the Production Officer, Public Works Officer, Service Group Superintendent and Utilities Superintendent (Shop 03) will immediately be notified verbally; notification to be verified in writing.

MT-PWHD-005293

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c. When using air for breathing purposes the air line respirator and associated equipment will be used as prescribed in LBNS Safety Supplement No. 0114.6.

8. CLEANING. Cleaning of compressed air systems will be accomplished in accordance with procedures established by the Quality Assurance Officer.

9. REINSTALLATION AND TEST. Reinstall components that have been removed, and reconnect piping using only lubricants and thread compounds approved by NAVSHIPSINST 9230.15B.

10. OTHER APPLICABLE CODES. In addition to the foregoing procedures, the following shall apply: Applicable codes of the American Society of Mechanical Engineers; the National Bureau of Standards; Bureau of Yards and Docks Instruction 11012.67; Department of the Navy Safety Precautions for Shore Activities, NAVSO P-2455; Bureau of Ordnance Pamphlet 1806, High Pressure Air Systems Ashore - Design and Operation; and the handbook of the particular item or equipment involved.

MT-PWHD-005294

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3. **Lubricating**

a. **Lubricate air compressors regularly.** Use only the proper grade oil as recommended by the manufacturer, and avoid the application of too much oil.

b. *Use only oils which have high flashpoints to lubricate the air cylinders of air compressors.*

4. **Cleaning**

a. Keep compressor, tanks, and accompanying piping clean to guard against oil-vapor explosion. Clean intake air filters periodically.

b. Use only soapy water or suitable non-toxic, nonflammable solution for cleaning compressor intake filters, cylinders, or air passages. Never use benzene, kerosene, or other light oils to clean these portions of a system. These oils vaporize easily and will form a highly explosive mixture under compression.

5. **Adjustment and Repair**

a. Turn off the motor before making adjustments and repairs on an air compressor.

b. Before working on or removing any part of a compressor make certain that the compressor is secured and cannot be started automatically or by accident, that air pressure in the compressor is completely relieved, and that all valves between the compressor and receivers are closed.

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MT-PWHD-005295

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J-M 83

CHAPTER 8



MT-PWHD-005296

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Chapter 8
CONSTRUCTION

GENERAL

0801. SCOPE

These requirements for personnel safety are designed to cover the dangerous conditions ordinarily experienced by personnel engaged in construction and maintenance work at naval shore activities and advanced bases. The *American Standards Association Safety Code for Building Construction*, A-10.2, contains additional safety rules for the various fields of activity which constitute the building construction industry. Public works officers and others responsible for the safety of personnel employed on construction and maintenance work should have a current copy of the code and be familiar with its provisions.

0802. DRINKING WATER

1. **Dispensing Methods.** Fresh and pure drinking water shall be supplied on every construction job. Drinking water will be obtained only from sources approved by the public works officer or the officer in charge of construction. Any one of the following dispensing methods shall be used:

a. Stationary bubbler with guarded orifice installed on an approved water line.

b. Fully enclosed water container and individual paper drinking cups.

c. Portable sanitary drinking fountains which meet current Federal specifications.

2. **Containers.** Dipping water out of any container by individual cup, dipper, canteen, or other utensil, is prohibited. Containers must be provided with a covering so designed and fastened as to prevent such use.

3. **Sterilization.** All containers used to furnish drinking water shall be thoroughly sterilized at least once a week, or more frequently if circumstances require, by methods approved by medical authorities.

0803. TEMPORARY TOILET FACILITIES

1. **Number Required.** For every 30 persons or less a privy or closet space shall be provided.

2. **Privacy.** It shall be constructed so that the occupant thereof will be shielded from view and protected against the weather and falling objects.

3. **Location.** Privies shall be located so as not to contaminate any domestic water supply used for drinking purposes.

4. **Drainage.** They should be so located and banked that surface water cannot flood the pit.

5. **Trough.** Each privy shall be provided with an adequate urinal trough.

6. **Sewer connections.** If sewers are available, connections shall be made at once, flush tank closets installed, and running water provided to keep the closet flushed.

7. **Pit Latrines.** At locations where neither a water carriage sewerage system nor chemical toilet is available, the privy or closet space shall contain a fly-tight box constructed over a pit latrine or over pails, or other suitable containers, where pits are impracticable.

8. **Sanitary Requirements.** Care shall be taken to see that all buildings used as temporary toilets are kept in a clean and sanitary condition. The toilet seats should be scrubbed daily with soap and water, and washed off at least twice a week with an antiseptic solution.

0804. FIRST-AID STATIONS

1. **Treatment Facilities.** Where medical facilities are not available at a shore activ-

1691

MT-PWHD-005297

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J-M 83

ity, a first-aid station or stations equipped with medicines and supplies common to first-aid treatment shall be established on each project at the beginning of operations and maintained for the duration of the job. On all projects employing fewer than 100 workers, 16-unit first-aid kits shall be provided in the ratio of one for each 25 persons employed and these kits shall be maintained with all the standard medicines and remedies.

2. Reporting Accidents. Workmen shall report all accidents, no matter how trivial. Minor injuries, when neglected, produce most of the infection cases. All injuries shall be given first aid or medical attention immediately.

3. Qualified Personnel. First-aid care shall be administered under the direction of a qualified person, a registered nurse, or a licensed physician.

0805. PERSONAL PROTECTION

1. Clothing and Equipment. According to the type of work being done, employees shall be required to wear chipper's goggles, welder's goggles, welder's shields, hard hats, safety shoes, rubber boots, safety belts, lifelines, life nets, life preservers or jackets, respirators, and other such protective equipment or clothing.

2. Sterilization. Personal protective equipment shall be properly cleaned and sterilized before being issued to employees.

0806. LIGHTING

1. Where Required. Stairways, corridors, passageways, railroad crossings, excavations, piled materials or obstructions, and working areas shall be kept adequately lighted while work is in progress.

2. When Required. Where working conditions require the use of artificial lighting it shall be maintained after a shift until workmen have had an opportunity to leave the premises.

3. Outdoor Operation. Outdoor operations shall be adequately illuminated at night (see article 0213).

0807. GAS AND SMOKE

1. Escaping Gas. No method of heating shall be used which releases smoke or gas within an enclosure where workers are employed.

2. Authorization. No fire or open flame device shall be permitted on a project without the approval of the supervisor or person in charge.

3. Pipes and Stoves. Where smoke pipes from stoves or other heating apparatus pass through combustible walls or roofs, proper insulating thimbles shall be provided. All stoves and other heating apparatus shall be mounted on incombustible bases and have proper fire protection at the rear and sides. See NAVDOCKS DM-8, *Fire Protection and Fire Prevention*.

0808. SALAMANDERS

The use of salamanders is to be discouraged. When they are used, however, constant attention must be given to fires and the following precautions must be strictly observed:

1. Foundation. Salamanders used in buildings shall be installed on a firm foundation and combustible floors shall be properly protected.

2. Cover. Salamanders must be properly covered with a sheet-metal hood and the exhaust piped to the outside air.

3. Clearance. Combustible walls should have at least three feet clearance; where the pipe goes through the roof or walls there shall be a nine-inch clearance to combustible material. The use of ventilating thimbles or cold shield pipes is recommended.

4. Used Outdoors. Salamanders used outdoors should be set directly on the ground; they need not be covered.

5. Used in Enclosed Spaces. When salamanders are used in enclosed spaces, proper tests for carbon monoxide should be made and such areas freed of any toxic gases and fumes before workmen are permitted to enter.

1692

MT-PWHD-005298

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J-M 83

6. Solid Fuel. Only solid fuel salamanders shall be used. The use of oil-fired salamanders is limited to extreme emergency conditions.

7. Moving or Refueling. When oil-fired salamanders are permitted they shall be shut down before being moved or refueled.

8. Liquid Fuel. Fires in salamanders shall never be started with gasoline, kerosene, or other flammable liquids.

9. Under Tarpaulins. Where salamanders are used for protection of concrete against freezing and the area is enclosed with tarpaulins or canvas, extreme care is required to prevent contact of salamanders with such materials.

0809. ELECTRIC WIRING AND EQUIPMENT

1. General. Temporary electric wiring and equipment shall be installed and maintained by competent and qualified workmen so as to effectively protect all persons against injury therefrom. Permanent installation should be in accordance with the National Electrical Code. See Chapter 15 Electricity and Electronics.

2. Grounding Equipment. Electrical equipment shall be grounded in accordance with requirements of Chapter 15.

3. Insulation Mats. Suitable insulating mats or platforms of substantial construction providing good footing shall be provided and so placed that operators or persons in the vicinity of machines or equipment having exposed live parts of more than 30 volts, cannot readily touch such parts unless standing on these mats or platforms, or on the insulating floor.

4. Extension Cords. Extension cords of lights and electrically operated tools or devices, together with their connections and fittings, should be of a superior quality. They shall be inspected frequently and be maintained in a safe condition. All extension cords shall be kept dry and free from oil or grease.

5. Switches. Underwriters' Laboratories approved safety-type switches shall be installed for all equipment, and the enclosures shall be grounded.

6. Fuses or Circuit Breakers. All circuits shall be fused or equipped with circuit breakers rated in accordance with the tables of the National Electrical Code. By-passing of circuit breaking devices is prohibited.

7. Deenergizing Circuit. Whenever work of any nature is to be performed on electrical equipment or circuits, all circuits and equipment should be deenergized and grounded. (Procedures prescribed in Chapter 15 shall apply.)

8. Hot Line Work. When workers are required to perform work on circuits which cannot be deenergized, such workers shall be fully qualified to perform hot-line work and they shall comply with procedures prescribed in chapter 15.

9. Explosive Gases. Special fixtures designed for hazardous atmospheres shall be used in locations where explosive gases or dust may be encountered.

10. High Voltage Wiring

a. Qualified Personnel. All work on electrical wiring and equipment carrying high voltage shall be performed by men competent and qualified in high voltage installations.

b. Instruction of Personnel. Workmen assigned to work on or in close proximity to electrical installations shall be given specific instructions on the work to be performed and the hazards associated therewith.

c. Warning Signals. High voltage lines erected for construction purposes, shall carry appropriate warning signals at all locations where equipment is operated, or where persons may come in close proximity thereto.

d. Wiring Diagrams. Wiring diagrams shall be prominently displayed in transformer rooms, switching stations, and other such installations.

e. Temporary Installation. Temporary wiring used in tanks, cofferdams, or other

MT-PWHD-005299

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J-M 83

confined spaces shall be equipped with an approved type safety-switch for cutting off the current in emergencies and such switch should be located at the entrance to such space. The enclosure of such switch shall be grounded.

0810. HANDLING AND STORING MATERIALS

1. General

a. Stacking In Tiers. All material in bags, containers, or bundles, and other material stored in tiers shall be stacked, blocked, interlocked, and limited in height so that it will be stable and otherwise safe against sliding or collapse.

b. Inside Storing. Material stored inside buildings under construction shall not be placed within six feet of any hoistway or floor opening, nor on any floor above the ground within ten feet of the outside of the building, unless the exterior walls extend above the top of the storage pile, in which case the minimum distance shall be six feet. Material shall not be stacked against interior columns or roof supports. Floors shall be shored if material stored is heavier than the flooring will support.

c. Public Thoroughfare Storage. When any material is stored in public thoroughfares, it shall be located so as to present the least possible hazard to the public or interference with traffic.

d. Barricades

(1) Day. The material shall be protected against being hit or knocked over by trucks or other passing vehicles by means of barricades and red flags during daylight hours.

(2) Night. The material shall be guarded at night by barricades and an adequate number of red lights located at conspicuous points.

e. Lifting. When handling materials by hand, workmen should always use the leg muscles in lifting, never the back. Help should be obtained if the load is too heavy or too clumsy to be handled by one man.

2. Piling Lumber

a. Gloves. Men piling lumber shall always wear leather gloves.

b. Timber Sills. Lumber shall be piled on timber sills to prevent direct contact between stored lumber and the ground. Sills shall be level and solidly supported.

c. Stacks. Lumber shall be so piled as to be safe against falling. The height of the pile shall not exceed 16 feet. The width of piles shall not be less than one-fourth the height. When unpiling, each tier shall be completely unpiled before beginning another.

d. Cross Strips. Cross strips shall be placed in piles which are stacked more than 4 feet high.

e. Projecting Nails. Used lumber shall have all projecting nails withdrawn before it is piled, unless it is burned without further handling.

3. Cement and Lime

a. Protective Apparel. Men handling cement and lime bags shall wear goggles. They shall always wear snug-fitting neck and wrist bands.

b. Protection of Skin. Men shall report any susceptibility of their skin to cement and lime burns. They shall make use of a suitable hand cream where its use will prevent burns. They shall always practice personal cleanliness. They shall not wear clothing that has become hard and stiff with cement. Such clothing irritates the skin and may cause serious infection. Men who are allergic to cement and lime should be transferred to other jobs.

c. Height of Stack. Bags of cement and lime should not be piled more than 10 bags high except when stored in bins or enclosures built for such purposes.

d. Direction of Bag Openings. The bags around the outside of the piles shall be placed with the mouths of the bags facing the center.

e. Setting-Back Tiers. To prevent piled bags from falling outward, the first 5 tiers of bags each way from any corner shall be crosspiled and a set-back made commencing with the sixth tier. If necessary to pile above the tenth tier, another set-back shall be made.

f. Back Tier. The back tier, when not resting against a wall of sufficient strength

1694

MT-PWHD-005300

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J-M 83

to withstand the pressure, should be stepped back one bag every five tiers, the same as the end tiers.

g. **Unpiling.** During unpiling, the entire top of the pile shall be kept level and the necessary step-backs every 5 tiers maintained.

h. **Lime Storage.** Lime shall be stored in a dry place to prevent a premature slaking action that may cause fire.

4. **Brick**

a. **Piled On Even Surface.** Brick shall never be piled directly on uneven or soft ground but shall always be stacked on planks.

b. **On Scaffolds.** Brick shall never be stored on scaffolds or runways. This shall not prohibit normal supplies on bricklayers' scaffolds during actual bricklaying operations.

c. **Height of Piles.** Except where stacked in sheds, brick piles shall never be more than 7 feet high.

d. **Tapering the Stack.** When a pile of brick reaches a height of 4 feet it shall be tapered back 1 inch in every foot of height above the 4 foot level.

e. **Unpiling.** The tops of brick piles shall be kept level and the taper maintained during unpiling operations.

5. **Masonry Block and Hollow Tile**

a. **Level Surfaces.** Blocks shall always be stacked in tiers on solid, level surfaces.

b. **Height of Stacks.** Stacked piles shall be limited to a height of 6 feet whenever possible. When blocks are stacked higher than 6 feet the pile shall be stepped back, braced, and propped, or wood strips placed between tiers to prevent the pile from toppling.

c. **Lowering Blocks.** Blocks shall not be dropped or thrown from an elevation or delivered through fully enclosed chutes.

6. **Reinforcing and Structural Steel**

a. **Gloves.** Men handling reinforcing steel shall wear leather gloves.

b. **Bending Steel.** Bending of reinforcing steel on the job shall be done on substantial benches secured against tipping. Benches shall be located on nonslippery level surfaces.

c. **Piling Steel.** Structural steel shall be carefully piled to prevent sliding or tipping over. If there is danger of tipping over, I-beams shall be stored with webs horizontal.

7. **Corrugated and Flat Iron.** Corrugated and flat iron shall be stacked in piles not more than 4 feet high. Spacing strips shall be placed between bundles. On permanent installations, this material may be stacked vertically or at a slight incline to the vertical, provided such stacking is in substantial racks of steel or concrete of an approved design.

8. **Pipe**

a. **To Prevent Spreading.** Pipe of all kinds shall be stacked in such a way as to prevent the stack from spreading.

b. **Approach From End Of Pile.** In removing pipe larger than two inches in diameter from storage piles which are more than one pipe high and run in the same direction, workmen shall approach the pile from the ends and not from the sides.

c. **Size of Pile.** If piled, sewer pipe shall be segregated by sizes, and the height of any pile shall not exceed 5 feet.

9. **Sand, Gravel, and Crushed Stone**

a. **Overhang.** In withdrawing sand, gravel, and crushed stone from frozen stock piles, no overhang shall be permitted at any time.

b. **Protection of Walls.** Material should not be dumped against walls or partitions. When this must be done, it should not be stored to a height that will endanger the stability of such walls and partitions.

c. **Lifelines.** When men are required to work in hoppers or on high piles of loose material they should be equipped with safety belts and lifelines having no more than 2 feet of slack.

0811. WHEELBARROWS

1. **Handles.** Wheelbarrows with cracked or broken handles shall not be used.

2. **Wheels.** Twisted and out-of-round wheels shall be repaired or discarded.

1695

MT-PWHD-005301

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J-M 83

3. **Knuckle Guards.** When wheelbarrows are used in narrow passageways, gloves or knuckle guards should be used.

4. **Balancing Load.** Wheelbarrow loads shall be balanced carefully with the center of the weight placed well forward to save lifting strain.

5. **Lifting With Leg Muscles.** When picking up a loaded wheelbarrow, the knees should be bent and the lifting done with the leg muscles.

6. **Pulling Prohibited.** Wheelbarrows shall always be pushed, *not pulled.*

7. **Running.** Workmen shall never run with empty wheelbarrows in an upright position. This practice leads to serious injury from stumbling and falling.

8. **Overloading.** Wheelbarrows should not be overloaded, especially when used on ramps.

9. **Leaving in Hazardous Spot.** Wheelbarrows shall never be left in such a position that they can readily tip over or fall or shall never be left where persons or traffic can run into them.

0812. LADDERS AND SCAFFOLDS

(See articles 0835 and 0836)

0813. FLAMMABLE LIQUIDS AND FIRE PREVENTION

Precautions pertaining to the handling and storage of gasoline and other flammable liquids are contained in Chapter 20. See article 0205 for general provisions on fire prevention.

0814. CONCRETE CONSTRUCTION

1. Form Building and Erection

a. Housekeeping. Good housekeeping shall be observed at each new concrete structure. Materials and tools shall be kept picked up, and special care shall be taken that no boards with protruding nails are allowed to lie around.

b. Protective Apparel. All workmen placing concrete shall wear protective hats whenever the hazard of overhead falling objects exists. Shirt sleeves should be rolled down, gloves should be worn, and every reasonable precaution taken to keep cement and concrete off the skin. Men required to stand in fresh concrete shall be provided with watertight boots.

c. Safety Belts. Men placing reinforcing steel where there is a falling hazard shall be equipped with lifelines and safety belts.

d. Supports. While concreting there should be one carpenter, or more if necessary, assigned to tighten wedges and to see that centering supports are not in danger of collapsing. Mud sills should be used on all shoring that rests on the ground, and shoring should be properly placed.

e. Temporary Scaffolds. Before decking has been put in place on joists, temporary scaffolding shall be erected as necessary to enable men to work safely. Workmen must be particularly careful not to walk out on cantilevered members of the form framing.

f. Column Forms. Men erecting column forms shall always install back braces and side braces so as to prevent any movement out and away from the building. They shall also use heavy tie-wire to tie in the tops of wood column forms to the slab-reinforcing steel.

g. Beam Forms. When the outside beam forms are in place, a continuous length of 3/4-inch manila rope shall be run from one set of column dowels to the next set at the outside of the building.

h. Raising Column Forms. When outside column forms are being raised from one floor level to another floor level, the area below the place where the column forms are being raised should be roped off.

i. Bracing Shores. In the setting of shores, all horizontal bracing should tie in all shores with the adjacent ones.

j. **Wheelbarrows.** Precautions to be observed by workmen using wheelbarrows will be found in article 0811.

2. Form Stripping.

a. Keeping Away from Area. Only men actually engaged in stripping work should be allowed in areas where stripping is being done.

1696

MT-PWHD-005302

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J-M 83

b. Concrete Must Be Set. Forms should not be removed prematurely; be sure that the concrete is properly set and that it is not frozen.

c. Supports for Forms. Before stripping, beam forms should be well supported by shoring.

d. Form Panels. When large panels are removed or handled by power equipment, rope tag lines should be fastened to the form panels to prevent the wind from swinging them against the men.

e. Cutting Tie Wires. When tie wires under tension are being cut, care should be taken to prevent a backlash which might hit the body, especially the face, eyes, or throat. Hammer and chisel shall not be used to cut tie wires.

f. Cleaning Lumber. Stripped lumber should be removed at once to a separate pile, then cleaned and all nails removed.

g. Protective Apparel. Workmen cleaning stripped lumber should wear heavy leather gloves and heavy soled safety shoes which are in good condition.

3. Spouting

a. Towers and Chutes. Where towers and chutes are used they should be strongly built by men experienced in this work. They should be checked daily and kept in good repair.

b. Tripods. Tripods should be solidly built, using strong material.

c. Guy Wires. Spouts should be guyed so they cannot sway in the wind.

d. Cleaning. Spouts should be cleaned out at the end of each run of concrete.

e. Barricades. Spaces below spouts should be barricaded to keep people or workmen out of areas where they might be injured by falling concrete.

4. Runways

a. Construction. Runways shall be strongly built, evenly supported, and have a smooth-running surface of sufficient width to prevent buggies from running off.

b. Support of Forms. Forms directly under runways should have extra supports.

c. Railings. Runways that are used for workmen's access shall have standard railings on open sides to protect the workmen.

d. Slope. Runways shall be built with such a slope that men will not slip. Cleats should be fastened to sloping runways when the incline exceeds one foot rise in a five foot run.

e. Keeping Clean. Runways shall be kept free of loose materials, ice, snow, grease, mud, and other causes of insecure footing.

5. Mixing and Placing Concrete

a. Tripping Over Tools. Tools such as shovels and hoes shall be placed where workmen will not trip over them or bump into them. The mortar box shall be placed clear of workmen's access ways.

b. Batching Truck. Workmen must make sure that the dry batch truck does not back up and pin them between the skip and the truck, or run them down. Dry batch truck drivers must exercise special care in backing up to the mixer skip to avoid injuring workmen around the skip. The driver should back up to the skip only on signal from the mixer operator or the skipman.

c. Catching Clothing in Moving Parts. Workmen must be careful not to get too near to moving parts, like revolving drums, cables, etc., thereby running the risk of their clothing being caught and drawing them into the machinery.

d. Dumping Load. When a mixer dumps a load of concrete into a bucket, care must be taken to see that the bucket gate is closed. Cables should be checked for defects to prevent the load being dropped.

e. Guards in Place. Pipe skip guards and safety chains on the paver must be kept in place.

f. Standing Under Skips. Every precaution must be taken to prevent people from standing or passing under a raised skip.

6. Concrete Buggies

a. Keep Clean. Concrete buggies shall be kept clean and in good repair.

b. Handles Guarded. The handles of concrete buggies should not extend beyond the wheels of either side. The handles of

1697

MT-PWHD-005303

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REDACTED
J-M 83

buggies should be equipped with knuckle guards.

c. **Stop Cleats for Dumping.** Stop cleats should be used at all places where buggies are dumping material.

d. **Balancing Load.** Loose weights should not be hung on the handles of buggies to act as counter balances; the load should be trimmed if possible. If weights become necessary, they shall be securely fastened to the handles.

e. **Moving Load of Concrete.** Workmen should not try to move too heavy a load of concrete, nor try to wheel a load over ramps that are insecure, narrow, or rough.

f. **Danger of Backing Trucks.** Workmen using buggies around concrete mixers shall be alert to see that a truck does not back up and pin them between the mixer and the truck.

0815. STEEL ERECTION

1. General

a. **Protective Apparel.** Workmen employed on steel erection operations shall wear protective hats at all times. They should wear safety shoes, gloves, and overalls without cuffs. They should wear safety belts when working 12 feet or more above the floor, and at all times when working over water or doing repair work on a ship's sides.

b. **Goggles.** Goggles of approved type shall be worn by workmen employed in cutting out rivets, caulking, burning, grinding, chipping, or similar operations.

c. **Welding.** Welding operations shall be shielded or screened when necessary for the safety of the workmen or others in the vicinity.

d. **Fresh Paint.** Workmen shall not work on steel members which have been freshly painted.

e. **Hoisting Material.** Material shall not be hoisted to a structure until it is ready to be put into position and fastened.

f. **Load Falls.** There shall be at least two parts in the load falls used in steel erection.

g. **Steel Cables.** Steel cables shall be used on all loads in steel erection. When hoisting steel a tag line should be attached to guide the load until it reaches the level where it is to be erected.

h. **Bolting Steel.** In setting steel, each piece shall be securely bolted before the line is taken off.

i. **Hoisting Workmen.** Workmen shall not be lowered or hoisted in tackle or runner lines or on a lead.

j. **Temporary Wiring.** Particular care shall be taken in the stringing of any temporary electric wiring which comes in contact with the steel. Wire with defective insulation shall not be used.

k. **Keep Tools in Boxes.** All rivets, bolts, nuts, dollies, wrenches, other tools, and other loose articles shall be kept in kegs or boxes so that vibration will not cause them to creep and fall through or over the edge of planking. All boards, planks, kegs, and other loose material shall be secured before leaving the job.

2. Riveting

a. **Throwing.** Hot rivets shall never be thrown across shaftways or toward the outside of a building. When riveting is done on outside walls, the rivets shall be passed by hand or thrown parallel to the wall.

b. **Catching.** Rivet catchers should use cone shaped buckets, pails, or cans of durable construction with wooden bottoms.

c. **Slings for Dollies.** Canvas, leather, or rope slings should be used for riveting dollies. Chain slings should not be used. The wire attachment on the rivet gun should not be allowed to become worn so that it may allow the tool to fly with the air pressure.

d. **Rivet Heaters.** A pail of water for fire extinguishing shall be kept at every rivet heater.

e. **Floor Requirements.** The riveting gangs and painters shall have a fully planked floor not more than two stories below them.

f. **Erection Ahead of Riveting.** When the columns are two or more stories in height the erection gang shall not be more than four stories above the riveting gangs. Where the column splices are at every story the distance between the erection gang and the riveting gangs shall not be more than two stories.

1698

MT-PWHD-005304

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J-M 83

3. Working Floors

a. Temporary Floors. The working floor, i.e., the floor on which the structural steel is being erected, shall be planked over solidly. The planking shall not be less than two inches thick (nominal thickness) and shall be laid close, so that nuts and bolts cannot slip through. The overlap shall be four inches or more. The planks shall be placed so they cannot tip under the weight of the worker at any point and so secured that they cannot slip out of place. All planking shall be sound, good quality material.

b. Loading Temporary Floors. All steel members deposited on temporary flooring shall be distributed so as not to exceed the safe carrying capacity of the floor.

c. Permanent Floors. In structural steel buildings the permanent floor construction shall be put in as the building progresses, and as closely behind the erecting, riveting, and painting as may be practicable. In no case shall the steel erection be more than eight stories above the uppermost permanent floor filling.

4. Safety Nets. Where it is impracticable to provide temporary floors on structures, as in theaters, auditoriums, and other such large open areas, rope nets shall be suspended below the points where men are working, or safety belts and lifelines (with a maximum slack of 4 feet) shall be provided to keep workmen from falling.

WEIGHT HANDLING AND CONSTRUCTION EQUIPMENT

0820. OPERATING RULES

1. Definition and Scope

a. Equipment. "Weight-handling Equipment (Heavy)" as referred to in this section, includes crawler and motor drawn cranes, gantry cranes, portal cranes, tower cranes, hammerhead cranes, overhead traveling cranes, floating and wall cranes, locomotive cranes, derricks, hoists and elevators, and crushing, mixing, batching, and paving equipment. It does not include fork lifts, straddle carriers, and pallet trucks; for safety precautions covering the operation of such equipment, see Chapter 3.

b. Transportation Equipment. Precautions for railroad and automotive equipment are to be found in Chapter 5.

2. Principal Causes of Accidents

a. Personnel. About 80 percent of all accidents involving equipment used in construction work and weight-handling are caused by unsafe practices of operating, maintenance, and other personnel involved in the operation of the equipment. It is possible for these personnel to perform their tasks on or about the equipment in an unsafe manner many times over a long period without accident. Eventually they become convinced that their unsafe practices actually are safe. Inevitably, their continued violation of the safety rules results in accidents. The body of safety rules in this field has been developed through the investigation and analysis of thousands of accidents. Full compliance with the rules is essential.

b. Unsafe Practices. The predominant unsafe practices and hazardous conditions in the operation of heavy construction equipment are listed below. Operators of all such equipment should study this list carefully, noting particularly the hazards connected with their own work. They should also heed seriously the instructions and warnings of their supervisors regarding safe practices to be followed during operation, making every effort to avoid accidents from any of these 14 major causes:

(1) backing and turning machines, swinging booms, lowering buckets, and performing similar operations without looking, warning, or signaling;

(2) getting on and off equipment carelessly while it is in operation, or riding equipment when not authorized to do so;

(3) operating equipment with defective brakes, clutches, cables, or other improperly functioning parts;

(4) working or walking under skips, buckets, or loads;

1699

MT-PWHD-005305

0008 REDACTED J-M 83

(5) failing to adjust controls properly before attempting to crank an engine;

(6) oiling, adjusting, or repairing equipment while it is in operation;

(7) using equipment with unguarded or inadequately guarded engine fans and other dangerous moving parts;

(8) failing to use personal protective devices or clothing such as goggles, safety shoes, gloves, and hard hats;

(9) failing to properly block equipment or heavy parts while repairing equipment;

(10) operating equipment in a thoughtless or unsafe manner, such as moving too fast over rough ground or working too near the edge of a soft fill;

(11) operating cranes too close to power lines without adequate watches and supervision;

(12) failing to secure equipment, brakes, booms, and movable parts before repairing, leaving, or moving the machine;

(13) poor housekeeping either on the equipment itself or in the operating area;

(14) overloading the equipment.

3. **Operation**

a. Qualification of Operators. Operators of construction and weight-handling equipment shall be tested and licensed in accordance with the applicable requirements of NAVDOCKS P-306, *Testing and Licensing of Construction Equipment Operators*. An apprentice or license applicant shall operate equipment only under the direct supervision of a licensed operator.

b. Physical Fitness. An operator who is not physically able or mentally alert shall not be permitted to start work with any piece of equipment.

c. Inspection. A frequent and regular inspection should be made of all machines. A well-maintained machine is usually a safe machine. All controls such as steering mechanism, brakes, and operating clutches shall be tested by the operator before any work is begun on a new shift. If any of these do not operate properly, they should be adjusted or repaired before any work is begun.

d. Grease. Good housekeeping is a prime necessity for safe and efficient operation. An accumulation of grease on a machine can cause falls and invites fires.

e. Refueling. Gasoline or diesel-operated equipment shall never be refueled while it is in operation. Frequent inspection of fuel lines and tanks for leaks will prevent fires as well as loss of fuel.

f. Gasoline Safety Cans. When transporting gasoline from general supply to equipment in 5-gallon quantities, safety cans shall be used. If tank truck service is not available, gasoline in quantities in excess of 5 gallons shall be transported in steel drums. All bungs shall be tight, and the drum itself checked for soundness. When dispensing gasoline from drums an approved pump should be used.

g. Leaving Machine. An operator shall never leave his machine while the engine is running.

h. Interrupting Work. Upon completion of a work shift, the bucket, dozer blade, etc., shall be rested on the ground, and the brakes and clutches set as recommended by the manufacturer.

i. Guarded Parts. All belts, gears, shafts, clutches, drums, fly-wheels, chains, and other reciprocating or rotating equipment parts shall be adequately guarded.

j. Removing Guards. Guards, safety appliances, or any other safety devices shall not be removed or made ineffective except for the purpose of making adjustments or repairs, and then only after the power has been shut off. These guards and devices must be replaced immediately after completion of the needed repairs and adjustments.

k. Adjusting Machines. No one shall ever attempt to repair, clean, oil, or grease any part of the equipment while it is in motion.

l. Signals. Adequate warning devices and signals shall be installed on all mobile equipment.

m. Lighting. Adequate illumination must be provided for any night operation. (see article 0213)

n. Designated Use of Machine. The use of a machine for any purpose other than on the work for which it was designed is both unsafe and inefficient and is prohibited.

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MT-PWHD-005306

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 0820

Subj: Weight Handling Equipment; general requirements and operator licensing

1. GENERAL. Naval Regulations require that all weight handling equipment be weight tested and inspected at least once each year, all crane hooks be subjected to an annual magnaflux inspection, and prescribed weight tests be performed on newly installed wire rope. The rated lifting capacity of weight handling equipment will be conspicuously posted in the cab of each crane. Overloading of cranes, although not desirable, may be permitted in specific instances upon approval of the Public Works Officer.

2. DEFINITIONS

a. Weight Handling (Weight Lifting) Equipment. The term "weight handling equipment" as used herein, applies to all types of mobile and stationary equipment, exclusive of materials handling equipment; and includes, but is not limited to: hoists; cranes of the overhead, wall, pillar and jib types; cranes of the gantry, semi-gantry or cantilever gantry types; cranes of the portal, tower, hammerhead, floating, locomotive, crawler or truck types; and derricks of the land and floating types (except the YD-171) including stiffleg and a-frame types. Truck and crawler cranes are included as weight handling equipment when used primarily for weight handling purposes; also included are chain falls, hydraulic and mechanical jacks, electrical chain hoists, air tuggers and air hoists.

b. Operator Inspections. A visual observation of the equipment components to determine their condition. This will include inspection of reasonably accessible structural members, hoisting cables, sockets, pins, sheaves, blocks, rollers, fastenings and other points of stress. This is a "start up" inspection conducted by the operator assigned. Operator inspections of overhead weight handling equipment controlled from the ground will be observations conducted from the ground.

c. Annual Weight Test. That test which is applied at least once every twelve months to each unit of weight handling equipment as described and outlined in NAVDOCKS TP-300 and NAVFAC/NAVSHIPS INSTR 11200.32A of 6 Oct 1970.

d. Acceptance Test. That test which is applied to any new or used unit of weight handling equipment which is received from any source outside the Long Beach Naval Shipyard as described and outlined in NAVDOCKS TP-300 and NAVFAC/NACSHIPS INSTR 11200.32A of 6 Oct. 1970.

e. Repair Test. That weight test which is applied when any repair is performed in connection with weight handling equipment which

1701

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J-M 83

affects the stability or safety thereof. In this connection, the unit will normally be subject to a weight test under operating conditions up to, but not exceeding, the posted capacity.

f. Wire Rope Test. That weight test which is applied to any new wire rope installed on weight handling equipment. The criteria and procedures for this test are described in Department of the Navy Safety Precautions for Shore Activities, NAVMAT P5100, Article 0821.

3. DEPARTMENTAL REQUIREMENTS

a. The Department having plant account cognizance of the subject equipment (including minor property-in-use) will:

(1) Provide funds for the maintenance and testing thereof.

(2) Issue detailed procedures to insure that inspections and tests are conducted only under the supervision of competent and qualified personnel fully conversant with the equipment.

(3) Accomplish maintenance work and conduct appropriate tests and inspections as outlined in this chapter.

(4) Initiate the proper work requests when the assistance of other departments or shops is needed. These requests will define the work, the place and time it is to be performed, and cite the funds to be expended.

b. The Department having custody of the equipment for operation, either permanently or temporarily, will insure that the Operator Inspection is conducted daily at the beginning of each shift during which the equipment is in its custody and during which the equipment will be used.

c. The Public Works Department will conduct annual weight tests for the YD-171.

d. The Production Department will initiate action to provide inspection, testing and maintenance of weight handling equipment under its cognizance and for naintaining records pertaining thereto. Jib booms attached to the building are the responsibility of the Public Works Department, but the hoist attached thereto is the responsibility of Production Department and will be tested by Shop 72 as requested by the cognizant shop.

(1) Shop 72 will be responsible for:

(a) Performing all tests on weight handling equipment as requested by the cognizant shops.

1702

MT-PWHD-005308

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J-M 83

(b) Making repairs to all weight handling equipment located in Production Department Shops and coming under the cognizance of the Production Department.

(c) Maintaining, repairing and testing all mechanical and hydraulic jacks assigned to custody of Shop 72.

(2) Shop 06 will be responsible for:

(a) Assigning, on a permanent basis, sufficient qualified machinists to Shop 72 Weight Handling Activity for the purpose of maintaining subject equipment.

(3) Financing

(a) Work performed on equipment for each Production Shop will be budgeted and paid for by the cognizant shop.

4. OPERATOR LICENSING. Personnel assigned to duties involving the operation of construction and weight handling equipment must be tested and licensed before being permitted to operate such equipment. The Public Works Department License Examiner (Code 902.3), located in Building 54, will conduct examinations and issue Operator Permits to qualifying applicants. In addition, the License Examiner will maintain the files and records necessary to administer the licensing program. Examinations will be given during regular working hours, Monday through Friday.

a. Application for permit. An application will be made by preparing Parts I and II of NAVDOCKS Form 2752. This application will be submitted to the License Examiner (Code 902.3).

b. Requirements and Qualifications. Applicants must meet personal and physical requirements of NAVSUPPUB 284 and NAVEXOS P-1063 and such additional personal and physical qualifications for operating specific items of equipment as required by the Commander, Long Beach Naval Shipyard.

c. Issuance of permit. Applicants will be issued a Construction and Weight Handling Equipment Operator's License, NAVDOCKS Form 2754, when all requirements have been complied with and attested to in writing by the License Examiner. Operators who have been issued such license will have this license on their person when operating either construction or weight handling equipment.

MT-PWHD-005309

d. Expiration and Renewal. All licenses will expire on the applicant's birth date each two years, consonant with the operator's year of birth. Approximately ninety days before the expiration date of the license, the immediate supervisor will review the types of equipment authorized on the license and arrange for renewal examinations and tests.

e. Permit Revocation. Licenses may be revoked or suspended for cause by the licensing activity. Licenses will be automatically suspended upon the occurence of a chargeable accident. In such case, a renewal examination and tests will be given not later than 15 days after license has been suspended. When equipment types are revoked, the Operator's License, NAVDOCKS Form 2754, will be returned to the License Examiner without delay.

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J-M 83

MT-PWHD-005310

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I-M 83

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g. Color Code. All Navy construction, fire fighting, railroad, utility, and weight-handling equipment shall be painted in accordance with the instructions contained in NAVDOCKS P-309, *The Application of Color to Shore Establishment*. District Public Works Officers shall see that all such equipment under their control is painted to meet the accident-prevention standards of that publication.

4. Signals

a. Identification of Signalman. Only one person should be designated as signalman, and both he and the machine operator shall be entirely familiar with the standard hand signals. Where possible, the signalman shall be provided some distinguishing article of dress, such as a brightly colored helmet. He must be in a position to closely observe the load and the workmen or intermediate signalman, and still be in plain sight of the operator at all times.

b. Standard Signals. The signal system in *American Standards Association Safety Code for Cranes, Derricks, and Hoists* (ASA B30.2-1943) shall be understood and used by all riggers and crane operators.

c. Emergency Stop. A 'STOP' signal may be given by any person and shall be obeyed by the operator.

d. Signaling Lift. The signalman is responsible for making sure that members of the crew remove their hands from slings, hooks, and loads before giving a signal. He shall also make sure that all persons are clear of bights and snatch block lines.

5. Riggers' Rules

a. Riggers' Safety Apparel. All riggers shall wear protective hats that meet current specifications in use by the Navy. Hats should be yellow so that operators can readily identify the rigging crew. They should also wear gloves, heavy work shirts with rolled down sleeves, or jackets, to protect arms and torso from contact with slings.

b. Safe Methods. Riggers and others using slings to attach lifts to hoisting equipment should use only the approved safe methods for properly fastening the slings to the load and to the hook. Only experienced men shall do this work. There must be no question about the load being secured against slipping. The load shall always be carefully calculated in advance and no attempt shall ever be made to lift a load greater than the rated capacity of the crane.

c. Rigging and Hooking Load

(1) Cylindrical Loads. While lifting loads such as shafting, by strap, chain, or wire rope wrapped around the load, the wrapping must be given at least two turns around the object.

(2) Point of hook. A load shall never be carried on the point of a hook.

(3) Closed hook. The rigging of a box, brow, or staging for the purpose of lifting or otherwise moving personnel shall be done only at the express direction of the master rigger. A safety type or closed hook must be used. In emergencies, the hook may be moused.

(4) Compressed Gas Cylinder Lifts. Magnets or slings shall not be used in lifting compressed gas cylinders. A cradle or platform shall be used to hold the cylinders.

(5) Alligator Clamps. Alligator clamps shall not be used in areas where personnel are engaged in other work in the near vicinity.

(6) Box Hooks. Box hooks are prohibited except for raising loads to a height sufficient to enable placement of slings or dunnage.

(7) Improvised clamps. Improvised clamps shall not be used at any time without express permission of the master rigger given immediately prior to performing the work.

(8) "Chocking load." When "chocking" a load, place the shackle so the pin will ride in the eye of the pendant, but not in the standing part, so the pin will not unscrew.

(9) Multiple loads. Two or more separately rigged loads shall not be hoisted in a single lift even though the total load may be well within the load capacity of the crane.

(10) Knots and kinks. The rigger in charge is responsible for seeing that chains or wire ropes are not kinked or knotted.

(11) Hoist block. Never make a hitch with chain or wire rope on the hoist block.

1705

MT-PWHD-005311

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J-M 83

(12) Dragging rigging gear. Chains or slings will not be permitted to dangle or drag under loads.

d. Hoisting Load

(1) Balanced load. Before hoisting, the rigger in charge shall make sure the load is balanced in the sling.

(2) Vertical hoist line. Before making the lift the rigger in charge shall see that the upper block is directly over the load to avoid swinging.

(3) Observing the load. The signalman shall keep his eye on the load as it is hoisted to see that nothing fouls.

(4) Kinks. If a kink is noted in a chain, the load must be lowered and the kink removed.

(5) Travel. When cranes are being used to make a lift, the position of the boom shall not be altered nor shall the load be raised or lowered while travel is being accomplished.

(6) Tag lines. Tag lines shall be used to guide lifts whenever there is a possibility of the load moving out of control. Tag lines shall be of adequate length and shall be kept free of loops and knots.

(7) Secure loose parts. Before hoisting the load, it shall be inspected and loose parts or other loose objects secured before hoisting.

e. Men Under Boom or Suspended Load. All personnel shall be cleared from areas near or under the boom or suspended load, except that if the master rigger decides the only possible way to perform the job is to have a man or men under the suspended load he may authorize such action. The master rigger shall personally inspect the site before giving such authorization. Riggers may be near the area under the boom or load but whenever possible they should move well clear when a strain is taken on the hoist line.

It should be realized that if a boom fails it will usually swing some distance laterally rather than falling straight down. It is therefore not adequate to merely clear personnel from the area directly under the boom or load. They must be cleared from areas to either side as well. The operator and the riggers are expected to use good judgment in deciding the extent of the area which should be cleared of personnel.

f. Riding the Load. No one will be permitted to ride the load without express authorization of the master rigger. He shall determine the necessity for and require the use of safety belts and life lines or other special precautions in such cases.

g. Riding Block or Hook. No one shall be permitted to ride the hoist block or hook.

h. Hook Capacity. The rigger in charge shall know the load capacity of the hook and shall see that such capacity is not exceeded.

i. Side Pulls. Cranes shall not be used to make side pulls; nor shall they be used with a snatch block to pull such objects as railroad cars where the actual load cannot be known.

j. Walking Under Load. Except as provided in subparagraph e above no one will be permitted to stand or walk under a suspended load. If necessary, a watch will be posted to warn personnel away.

k. Barricades. When making lifts in areas where vehicles or personnel are likely to enter, the area will be roped off or otherwise barricaded and signs or a watch will be posted.

l. Walking Ahead of Load. Chainmen or hookers shall walk ahead of load being carried to see that obstructions and personnel are cleared away before the load passes over. They shall walk ahead and to one side rather than in the path of the load.

m. Landing Loads.

(1) Clearances. Loads shall not be landed and left closer than 4'8" from the outside rail of a railroad or crane track nor within distances from buildings, fire hydrants, hose houses, fire alarm boxes, or other facilities, as specified in NAVDOCKS DM-8. An open passage shall be left at all times so fire protection equipment can be reached and brought into use when needed.

(2) On vehicles. Whenever materials are being loaded or unloaded from any vehicle by crane, the vehicle operators and all other persons except the rigging crew

1706

MT-PWHD-005312

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shall remove themselves from the vehicle and keep clear.

(3) Dunnage and shoring. Whenever materials are landed in work or storage areas, by crane, necessary dunnage or shoring shall be provided to prevent tipping or shifting of such materials.

(4) Spreading. Caution shall be used in landing loads such as bundled or bagged materials since they may spread.

(5) Withdrawing slings. When withdrawing slings from underneath a load, riggers should exercise caution to prevent the slings from flying loose and striking someone or catching and tipping the load.

1707

MT-PWHD-005313

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n. **Defective Rigging Gear.** When the rigging supervisor or rigger in charge is informed or otherwise discovers that rigging gear is defective, he shall have it removed from service and returned to the shop for repair and test or replacement.

o. **Small Materials Load.** When handling bundles of small materials, extra care should be taken to see that all parts are secured. Wherever possible place small pieces in a "skip-box."

p. **Sharp Corners.** Slings shall be given protection (pieces of rounded wood, heavy bagging, or old rubber tires) on sharp corners, especially in cases where the sling might slide.

q. **Keeping Clear of Crane and Hooks.** Riggers, as well as other personnel, must be continually warned to keep clear of cranes to avoid the possibility of being crushed between stationary objects and the rear end of cranes. Riggers should be especially careful to keep clear of swinging hooks.

r. **Maximum Capacity Loads.** Extra care shall be taken when handling near maximum capacity loads for a given radius. All rigging crew members shall be informed when this condition exists.

s. **Dragging Gear.** Rigging gear should not be dragged across the deck, as this causes rapid wearing and consequent weakening of the gear.

t. **Running Cable.** Workmen shall never grab hold of a cable as it runs off a drum or is being pulled through a sheave.

u. **Railway Cars.** Workmen shall not stay inside a railway car when a load is being lifted or lowered in the car since they have no means of escape should the load swing.

v. **Rigging Scaffolds.** Suspended scaffolds shall be rigged in accordance with at least the minimum standards prescribed in article 0836.

0821. ROPES

1. Fiber Ropes

a. **Inspection.** Fiber ropes used to support a human load shall be inspected when installed and thereafter as frequently as may be necessary to insure their safe condition. Visual inspection should be made for abrasion, broken fibers, cuts, fraying, and deterioration due to corrosive substances. Ropes found to have defects shall be removed from such service.

b. **Dragging Rope.** Rope shall never be dragged along the ground or over rough or dirty surfaces.

c. **Storing Rope.** Ropes not in use should be stored in a dry, well ventilated place supported on slats or hung in loose coils. They shall never be exposed to lime or acids, nor stored in a room containing acids.

d. **Sheaves and Blocks.** Sheaves and blocks built for wire rope shall never be used for fiber rope.

e. **Sharp Edged Burdens.** When objects with sharp edges are to be lifted with ropes, protective pads shall be placed between the edges and the rope.

2. Wire Rope and Slings

a. **Wire Rope Reeving.** Standards for wire rope reeving systems given in NAVDOCKS DM-38, *Weight Handling Equipment and Service Craft,* shall be observed as applied to weight-handling equipment.

b. **Rust Prevention.** Wire rope slings shall be frequently inspected and lubricated in accordance with manufacturer's recommendations, to keep them pliable and prevent rust. Rusty ropes are dangerous because corrosion can then quickly develop inside and outside.

c. **Storage.** Wire rope should be stored in a place protected from the weather and acid fumes. It should not be stored in places where acid has been or is kept. It should also be protected from uric acid.

d. **Twisting.** A wire rope should be handled carefully so that it is neither twisted nor untwisted.

e. **Removing Rope from Service.** Wire rope shall be removed from service when:

(1) the number of broken wires in any pitch length or lay of rope totals the number shown in the following table:

1708

MT-PWHD-005314

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Wire rope	*Number broken wires*
6 x 7	3
6 x 19	6
6 x 37	9
8 x 19	8

(2) the wires in the crown of the strand are worn to less than 60 percent of their original diameter;

(3) inspection indicates a dangerous amount of corrosion or distortion.

f. Damaged Equipment. Hooks, shackles, rings, pad eyes, or slings that have been deformed or damaged shall be removed from service.

g. Rope End Connections. Only qualified riggers shall fabricate rope end connections for use on weight-handling equipment or slings.

(1) Speltered sockets. Forged-steel speltered sockets are required to be used for wire rope end connections on all portal, tower, floating, hammerhead, overhead traveling, wall and gantry cranes. Speltered sockets should also be used on all other cranes except where forged-steel wedge or swaged sockets are used. Spelter means *zinc* and zinc only. Speltering shall be performed as specified in NAVDOCKS P-300, *Management of Transportation Equipment*. See also NAVDOCKS DM-38.

(2) Wedge sockets. Forged-steel wedge sockets may be used where it is frequently necessary to detach rope ends to change from hook to bucket work.

(3) Swaged Connections. Swaged connections are permissible only when factory installed by the manufacturer.

(4) Clamps, clips, and screw wedges. Clamps, clips, and screw-wedge rope end connections are prohibited on any weight-handling equipment.

h. Rope Clips. Where wire rope clips are used to assemble a connection, the U-bolt shall be over the bitter end of the rope and the minimum number and spacing of clips shall be in accordance with the following table:

Diameter of wire rope (inches)	*Size of clip*	*Number of clips*
5/16	3/8	3
3/8	3/8	3
7/16	1/2	4
1/2	1/2	4
5/8	5/8	4
3/4	3/4	4
7/8	1	5
1	1	5
1 1/4	1 1/4	5
1 3/8	1 1/2	6
1 1/2	1 1/2	6
1 3/4	1 3/4	6

Spacing between clips shall be approximately six rope diameters.

i. Inspecting and Tightening Clips. All end fittings such as sockets, Fiege connectors, and wire rope clips should be examined before the equipment is put in use to determine if there is an area of break adjacent to the fitting. Clips should be tightened after the first hour of running time and also at all regular inspections. After comparatively long use, clips should be removed and the rope examined for broken wires. If any are found, the damaged part should be removed and a new attachment made.

j. Adjustment to Guy Wires. No adjustment shall be made to guys while any workman is aloft on a guyed pole or mast.

k. Protective Pads. See article 0820.5p.

0822. SHEAVES AND DRUMS

1. Worn Equipment. Sheaves, drums, or pulleys which have become worn, chipped or the grooves corrugated shall not be used because they will injure the rope.

2. Use Proper Rope. Sheaves and blocks designed for use with fiber ropes shall not be used for wire rope, since they are not strong enough for that service and the wire rope does not fit the sheave grooves.

3. Gate Block Hooked. A gate block shall always be closed and hooked before being used.

1709

MT-PWHD-005315

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0823. CHAINS

1. **Dangers.** All hoisting chains shall be inspected at frequent intervals for defects as stretch, wear, gouge marks, open welds, or fractures as indicated by very fine surface cracks, and shall be removed from hoisting service when such defects are found. Chains are less reliable than manila or wire rope as they break without any warning.

2. **Stretched Chains.** Chains which have stretched more than 5 percent in any five-link section shall be discarded. Chains, which in any individual link show wear greater than 25 percent of the thickness of the metal, shall be removed from service.

3. **Storing Chains.** Chains shall not be stored where they will be run over by tractors, trucks, or other equipment.

4. **Makeshift Repairs Prohibited.** Makeshift repairs such as splicing with bolts shall not be made on hoisting chain or chain slings.

5. **Kinks.** Chains should not be subject to sudden shock while in use. Loads shall not be lifted with a kinked or knotted chain.

6. **Fittings.** Attachments or fittings for chains should be of the type, grade, and size suitable for service with the size of chain used.

7. **Annealing Wrought Iron Chains.** Wrought iron chain shall be annealed by qualified workmen at least annually and a record of such treatment maintained. Alloy chain shall never be annealed.

0824. HOOKS

1. **Strength.** Hooks and rings used with chain should have at least as great strength as the chain. Hooks should be given a visual inspection at the beginning of each work day and prior to lifting the full rated load.

2. **Bent Hook.** Hooks bent to the extent that the throat opening is increased more than 15% or the point is more than 10° out of plane shall be discarded. They shall not be put back in service.

3. **Safety Latch.** Safety latch hooks in good condition should be used in operations where there is danger of catching the load on an obstruction; where heavy, stiff slings are used; and where ammunition and explosives are being handled. This applies particularly to hoisting buckets, cages or skips used in shaft work. (See article 0820.5)

4. **Testing and Marking.** Hooks shall be tested and marked as prescribed in NAVDOCKS P-300.

0825. CRANE OPERATION

1. **Chief Hazards.** Pertinent paragraphs of article 0820 apply to the operation of all types of cranes. The primary hazards of operating mobile type cranes, shovels, and draglines are:

a. **Unsafe Equipment**

(1) dropping or slipping of load;
(2) breaking of cables;
(3) non-use of outriggers;
(4) faulty or poorly adjusted brakes and clutches;
(5) clutch or brake slipping and allowing boom radius to increase;
(6) job exceeding safe boom radius;
(7) job exceeding capacity of crane;
(8) operating with bent or damaged boom;
(9) non-use of mousing or safety-type hooks.

b. **Unsafe Practices**

(1) overloading or exceeding capacities;
(2) obstruction to the free passage of boom or the load of the crane;
(3) backing and turning of machines without looking or signaling;
(4) operators not being familiar with equipment;
(5) operating on uneven ground;
(6) lifting load to an unknown greater radius;
(7) boom contacting high tension wires;
(8) using weight indicators without checking by common-sense judgment;
(9) not changing capacity charts on cranes when different boom lengths are used;

1710

MT-PWHD-005316

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(10) use of boom with bent or dented chord members;

(11) use of weight indicators as weighing devices;

(12) use of crane for towing.

2. **Inspection**

a. **Safe Load Capacity.** Every crane shall be inspected and tested annually for safe load capacity in accordance with NAVDOCKS P-300. The safe load chart shall be posted in a prominent place in the cab near the operator, who shall familiarize himself with the safe working and tipping capacity of that crane.

b. **Boilers.** Boilers on steam-operated cranes should be periodically inspected and tested in accordance with the ASME Power Boiler Code.

3. **Operator Responsibility.** Crane operators are responsible for knowing the limitations and capabilities of the cranes in their charge. They shall not attempt, nor shall they be required or permitted, to operate a crane in an unsafe manner or to operate a crane known to be in unsafe condition. Operators shall promptly report any malfunctioning or other defects in the equipment. Operators shall have the authority to stop and refuse to handle loads until safety has been assured.

4. **Personnel Restrictions**

a. **Authorized Crane Operators.** Cranes shall be operated only by authorized personnel who are thoroughly trained in the fundamental rules of crane safety. (See article 0820.3a)

b. **Boarding Crane.** Operators shall enter and leave the crane by means of the ladder provided for this purpose. No other person shall board a crane until permission has been given by the operator.

c. **Climbing on Moving Crane.** No personnel *except* the operators, and, on occasion examiners, supervisors, trainees, or repairmen, shall be permitted on the crane while it is in operation. No more than three such persons shall be in the cab at any time while the crane is in operation. No one shall ever climb on or off a moving crane.

5. **Calculating Load.** The weight of the material to be lifted should always be carefully calculated in advance; no chances should be taken on the result of a quick estimate. Also the radius at which the load will be lifted and set down should be accurately determined and compared with the capacity chart of the machine. On almost all truck, crawler, and locomotive cranes the weight of the hook, blocks, cable, and slings is part of the lifted load. Allowance must be made for this extra weight.

6. **Lifting Load from Water.** When lifting a load from water, its condition should be noted carefully. Contained water, or water in a water-logged structure, should be computed as a part of the weight. When the load leaves the water the crane takes on the added load as its buoyancy is lost. Unknown weights should never be lifted from the water. Water-logged loads or loads from water or mud should never be handled unless expressly authorized by an officer or supervisor qualified to determine the capability of the crane to handle the load.

7. **Testing Load.** When a heavy load is to be handled, the load shall first be raised a few inches to find out whether or not there is undue stress on any part of the sling and to make sure that the load is well balanced. If anything is found to be wrong with the brakes or engine, or with the adjustment of the sling, the load shall be lowered at once and no attempt made to move it again until the necessary adjustment or repairs have been made.

8. **Testing Brakes.** When lifting a capacity load, the brakes should be checked by stopping the lift a few inches above the ground and holding it with the brake. After rains, or under certain atmospheric conditions, brake linings may be wet and may not be fully effective until they have dried out. Operators should test brakes at the beginning of a new shift, after a rain storm, or at any time it is reasonable to suspect that brake linings may have become wet.

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MT-PWHD-005317

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 0825

Subj: Cranes

Ref: (a) NAVMAT P-5100, Articles 0825-0830
(b) NAVFAC/NAVSHIPSINST 11200.32A CH-1 of 18 October 1972
(c) NAVFAC P-300 "Management of Transportation Equipment" of September 1971
(d) NAVSHIPYDLBEACHINST 5450.2C (141) of 1 October 1971

1. PURPOSE. To supplement reference (a) with additional instructions concerning crane operations, inspection, testing and certification.

2. GENERAL

a. The Public Works Department provides, operates, inspects and tests all weight handling equipment in the Shipyard in accordance with reference (b). In addition, inspection, test and certification services are provided for satellite activities. The Production Department provides rigging crews and services for offshore activities as well as the Shipyard and Supply. In addition, cranes and operators are provided for the Naval Station and satellite activities for use under their operational control.

b. There is no conflict of interest or responsibility in the assignment of these duties to two departments. There is, however, a continuing need to insure that responsibilities are plainly delineated so that safety in crane and rigging operations is always present and that economy is always practiced.

3. POLICY. It is Shipyard policy that:

a. The Public Works Officer, Code 400, will provide and maintain cranes in sufficient quantities to meet recurring needs; employ a sufficient number of qualified operators to man the necessary cranes; train operators for Shop 02; disptach cranes, inspect, and conduct all tests of cranes.

b. The Director, Crane Test and Inspection Branch, Code 424, responsible to the Public Works Officer, will inspect, test, and certify all cranes in the Long Beach Naval Shipyard. All cranes must be certified in accordance with reference (b) prior to assignment by the Transportation Superintendent and by the Weight Handling Operation Branch.

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J-M 83

c. The Production Officer, Code 300, will deterine and keep the Public Works Officer informed of short and long term crane requirements; receive and process requests for crane service, and provide qualified riggers for work with active cranes.

4. DEFINITIONS

a. Cranes. Weight handling equipment of the portal, bridge, mobile and floating types.

b. Crane Operators. The Public Works Department employees of Shop 02 trained, qualified and assigned to the operation of Category I and Category II Shipyard cranes. For Category III cranes, the equipment operation responsibility rests with the respective Shop Superintendent and his assigned personnel.

c. Riggers. The Production Department employees of Shop 72 qualified in the use of cranes, the use and application of rigging gear, hoisting equipment, etc., in the field of weight handling.

d. Oilers. The Public Works Department employees of Shop 02 qualified and assigned to lubricate, gas, clean, and make minor adjustments on Shipyard cranes.

e. Track Walkers. (Crane pilots, crane guards): Persons assigned occasionally by either Shop 02 or Shop 72 to the duty of insuring cleared tracks and aligned switches for Shipyard cranes.

f. Active Cranes. Cranes which have been inspected and tested by Code 424 and certified by Code 400 in accordance with reference (b); in all respects fit for the service to which assigned and working with operator and rigging crews in response to requests from Shop 72.

g. Inactive Cranes. Cranes not assigned for reasons of withholding of certification (for unsatisfactory conditions), no need, deadline, lack of crew, or other causes.

h. Crane rights of way. Those areas parallel to the crane tracks (portal, locomotive, and wing wall) as indicated by white traffic lines painted on both sides of the track rails.

i. Crane Test and Inspection Branch, Code 424, is directly responsible to the Shipyard Public Works Officer, Code 400, under reference (d), and has the responsibility for scheduling, directing and conducting timely maintenance and safety inspections of all Shipyard weight handling equipment described in NAVFAC Manual DM-38 (Design Manual for Weight Handling Equipment and Service Craft). Such safety checks are performed in accordance with reference (b). The Code 424 group is composed of trained,

MT-PWHD-005319

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J-M 83

qualified, experienced mechanical, electrical and structural inspectors plus assigned mechanic, electrician, crane operator, and rigger. The annual weight test of each crane in the Shipyard (and the recommendations for upgrading of equipment, improving crane condition and improving safety among many other duties described in reference (d)), contribute to safe, reliable and economical operation, described below.

5. SPECIFIC SAFETY REQUIREMENTS

a. The Service Group Superintendent, Code 970, is responsible for the safe and economical performance of all rigging and weight-lifting operations which have been assigned to the Shipyard operational control.

b. The rigger to which a crane has been assigned is responsible for the following:

(1) Determining that rigging gear is in a safe operating condition and is properly handled before, during, and after use.

(2) Prohibiting any person from passing between portal crane and the parapet walls on piers and around drydocks.

(3) Directing the crane's operational movements necessary to spot the boom and hook for loading and for landing of the load in a safe manner, insuring that there is sufficient clearance to allow boom and machinery house counter weight to pass before giving operator a signal.

(4) Insuring that:

(a) All weight lifting operations under this cognizance are conducted in strict compliance with Shipyard rigging practices, including the use of standard crane signals.

(b) Crane right-of-way is clear of all obstructions prior to signaling for a tracking movement for an active status crane.

(c) Track switches are properly aligned before signaling for a tracking movement.

(d) Active crane operators stop at all switches and turntables when moving from location to location in a manner whereby the switches can be observed by the operator. (This does not include active cranes traveling repeatedly over the same switch in a single location).

(e) Active crane operators come to a complete stop at intersections when moving and that no collision hazard exists before signaling the operator to proceed.

(5) Assuring that a rigging supervisor is present and is directing the work whenever a load approaches the rated capacity of a crane.

MT-PWHD-005320

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J-M 83

(6) Track walking active cranes from location to location.

(7) Positioning of active cranes at the end of a work period to assure proper clearance of fire lanes and positioning of boom in relation to ship's structure, buildings, wires, or other obstructions.

c. The Transportation Superintendent, Code 902, under the Public Works Officer is responsible for the development, training and maintenance of operating work force including crane operators.

d. The General Foreman Crane Operator is directly responsible for the assignment of personnel and crane equipment and for the operation of all weight handling equipment.

e. The Crane Operator. Only a crane operator WG-11 will operate portal, floating, truck, crawler cranes, and derricks. Only Bridge Crane Operators or Crane Operators WG-11, will operate overhead electric bridge cranes unless otherwise directed by Shop 02 supervisor. The Crane Operator is responsible for the following:

(1) Knowing the limitations and capabilities of the cranes in their charge. They shall not attempt, nor shall they be required or permitted to operate a crane in an unsafe manner or to operate a crane known to be in unsafe condition or "red tagged" due to unsatisfactory conditions as described in reference (b). Operators shall promptly report any malfunctioning or other defects in the equipment. Operators shall have the authority to stop and refuse to handle loads until safety has been assured.

(2) The operating crew shall never be permitted to load any weight handling equipment in excess of its rate lifting capacity without specific authorization from the officer responsible for the operation of the unit. Every instance of exceeding the rated capacity shall be duly considered. In such cases, decisions as to the safe lifting capacity within the overloads in accordance with references (b) and (c), shall be made by the Public Works Officer. In no case shall a lift exceeding the recorded test be made without specific authorization from the Public Works Officer.

(3) Assumes responsibility for the crane to which assigned. Through use of Crane Operator's Checklist Card he insures efficient functioning of its mechanical and electrical equipment in order to provide safe operation. Shop 02, crew members, may be provided to assist in prompt crane maintenance and repairs.

MT-PWHD-005321

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J-M 83

(4) Insuring that all weight lifting operations under his cognizance are conducted in strict compliance with reference (b) standard practices, this manual, and good judgement.

(5) Making an inspection of the crane for visual defects at the beginning of each shift. The operating engineer or operator will then test the limit switches, warning, and safety devices, and ascertain that sufficient charged fire extinguishers are aboard. If the crane is found defective in any manner, the operator will secure all operating controls on the crane and immediately notify his supervisor. Electric cranes will have the main switches opened and tagged. The crane will not be operated until approval is obtained from the supervisor in charge of crane maintenance, the Public Works Department.

(6) Prohibiting personnel from riding on lifts and slings being handled by a crane for any purpose, except when authorized by a Shop 02 or Shop 72 supervisor, and from riding on any crane unless engaged in operation or repair thereof.

(7) Being cognizant of the conditions under which each lift is performed, alert to hazards in connection therewith, and taking action to avoid overloads and unsafe conditions.

(8) Knowing the rated capacity of his crane and not lifting greater loads. If, in the operator's opinion, the weight is greater than the rated capacity of the crane, he will inform the rigger. The load must not be hoisted until the weight has been established to be within the capacity of the crane. When handling heavy loads, the load will be lifted a few inches, the brakes applied and if the brakes fail to hold, the load will be grounded and the crane will not be operated until repairs have been made, and tested. Approval for use will be granted by the supervisor in charge of crane operations, the Public Works Department.

(9) Knowing the positions and insuring the clearance of the rotating part of the crane, particularly boom and cab clearance, with respect to adjacent structures and ship's rigging. At any time that the operator is uncertain of the clearance or a part, he will stop the crane and request the rigger to reassure him that his crane will clear any obstruction.

(10) Executing the normal hoisting, sluing, and tracking of the crane between the point of pickup and point of delivery.

(11) Not placing the crane in operation until the rigger is in plain sight and gives the proper signal. In addition, he will respond

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J-M 83

to the standard crane signals of the rigger and execute all crane movements without snapping, jerking, side pulls or sudden starts or stops.

(12) Exercising caution when approaching curves, intersections, or building entrances, and entrances to ladders leading into drydocks, and give ample warning of approach by ringing the bell or sounding the whistle.

(13) Immediately stopping the crane's travel when so signaled by the rigger: bringing the crane to a full stop at intersections and not advancing until given the proceed signal by the rigger; stopping the crane at each switch when traveling from location to location assuring himself by visual observation from the cab that the switches are properly aligned and then travel slowly through the switches. (This does not include active cranes traveling repeatedly over the same switch in a single location).

(14) Under no circumstances leaving his station without grounding the load and securing the crane in accordance with instructions posted within the operator's cab.

(15) Securing and tagging all operating controls and switches before repairs or adjustments are made, and when electric magnets, buckets, etc., are removed or replaced.

(16) When handling molten metal, making certain that the load does not pass over personnel working below.

(17) Making a full use of warning devices to warn personnel from walking under a load.

(18) Maintaining good housekeeping and sanitation in strict conformance with local instructions.

6. GENERAL REQUIREMENTS

a. In carrying out the foregoing, it will be the further responsibility of the crew members, riggers, and operators alike, to use the utmost caution when a potentially dangerous situation exists, to protect load, crane, adjacent structures, vehicles and equipment. Whenever there is any doubt as to the safety of proceeding, it will be the duty of any one or all crew members to stop operations until such time as the situation is clarified to the satisfaction of all concerned and it is safe to continue operations. Nothing in the responsibilities and instructions delineated in this instruction will be interpreted as excusing any member of the crew from being alert to detect and take proper action to avoid dangerous situations.

MT-PWHD-005323

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J-M 83

b. The specific responsibilities of the rigger enumerated in paragraph 5.b. in no way relieves other personnel from their general responsibility of safeguarding themselves, persons under their supervision, and their vehicles or equipment when entering, crossing, or using crane rights-of-way.

c. Except in production operations, a crawler crane without a load will not be moved under its own power in excess of 200 feet unless the boom is secured in a position parallel to the direction of travel.

d. No material of any kind will be placed within four feet of any railraod or crane track.

e. Cranes will not be used for sidepulls unless authorized by the responsible Shop 02 supervisors at the site, who will first determine that the stability will not be endangered thereby, and the boom, cables, etc. will not be overstressed.

f. Cranes will not normally be used for pulling lines and gear in connection with the docking or undocking of ships, except in an emergency when authorized by the Docking Officer or at other times if authorized by the Public Works Officer.

g. Signals

(1) A signal improperly given or a flag or light improperly displayed, will be regarded as a stop signal by all crane operators.

(2) The absence of a signal light or flag at a place where one is usually displayed will be regarded as a stop signal by all crane operators.

h. When floating cranes are operating offshore, the rigger in charge of the work will be responsible for all voyage movements as well as security of the craft (i.e. overnight alongside of ship) unless a qualified pilot is aboard who will then be in charge of the voyage.

i. Placing of outriggers may be requested by either the crane operator or the riggers.

j. Floating cranes shall be prepared properly for sea (out of breakwater area), boom shall be placed in boom rest, machinery house secured with spud lock, turn table of crane fastened with turnbuckles to crane base and hook blocks secured to deck with slings.

MT-PWHD-005324

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J-M 83

k. When holding a load aloft for an extended period of time, the hoist drum locking pawl will be engaged (vice holding load with foot brake).

l. Hoisting personnel

(1) When hoisting personnel with a truck crane, cruiser crane, or crawler crane, the main hoist (vice whip line) will be used.

(2) Under no circumstances will a "headache ball" be attached to the rigging while hoisting personnel with a truck crane, cruiser crane, or crawler crane.

(3) The AFDL-42-2 (Keystone wingwall crane, free-wheeling) will not be used for hoisting personnel.

(4) On those cranes having appropriate operating features, personnel boxes and heavy leads will be lowered through the gears (load will be "powered down").

m. When a load is being held aloft, the crane operator shall not leave the controls until all drum locking pawls ("dogs") are correctly set and a qualified operator is present to relieve him.

n. When handling any load aloft, the crane operator shall be alert at the controls and ready to react to sudden developments.

7. MOVEMENT OF CRANES TO THE MOLE AREA. In order to limit the accidental contact of the crane boom and/or hook with power lines, it is necessary to restrict the movement of cranes near these lines whenver possible. Cranes traveling to the Mole area will travel west along Avenue "C" to West 4th Street, turn south on West 4th Street to Avenue "A", turn west on Avenue "A" to 1st Street, turn south on 1st Street to the intersection of the outboard Mole Road which is now one-way outboard to Piers #15 and #16. On the return, the cranes will use the inner Mole Road, turning right on Avenue "A" to East 4th Street, north on East 4th Street to Avenue "C" and east on Avenue "C" to Shipyard. When it is necessary to pass under power lines, the operator will assure that one of the crew will dismount and survey this travel, being extremely cautious and alert. Signs will be posted in these areas warning of either overhead power lines or telephone lines.

MT-PWHD-005325

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J-M 83

9. Hoisting Line Vertical. Before lifting a near-capacity load, operators must be sure the hoisting line is vertical. They should move the crane to position rather than lower the boom; a swinging capacity load increases the chance of tipping. They should never try to lift tied-down loads, or pull pipes or other objects out of the ground.

10. Lowering Boom. Lowering of the boom under load shall be done only with the greatest caution, checking the radius-load capacity chart, and radius indicator where necessary. Lowering the hoist line and the boom simultaneously shall never be done.

11. Speed of Lowering. When lowering loads, the speed should be limited; it should not exceed the hoisting speed of the equipment for the same load. The ordinary hoisting speed of a 30 ton motor-operated crane is about 18 feet per minute with rated load. Stopping the load at such speeds within a short distance may double the stress on the slings and crane.

12. Swinging Loads. Care shall be exercised continuously to guard other workmen, buildings, or scaffolds against injury from swinging loads. Loads should not be swung over workmen. If it is absolutely necessary to move loads over space with personnel working below, adequate warning must be given by bell or siren so the workmen can move into safe places.

13. Dual Lifts. Dual lifts are extremely dangerous and should be attempted only when absolutely necessary, and then only under competent supervision throughout the entire operation. Before making a dual lift the proper position of the cranes and the location of the slings to balance the load properly for each crane should be carefully determined. Shifting of the load would cause overloading and failure of one crane, thus throwing the entire load onto the second crane and resulting in the failure of both cranes.

14. Exceeding Rated Load

a. When Permitted. When successfully conducted official tests with overloads not exceeding those listed in NAVDOCKS DM-38, *Design Manual, Weight Handling and Service Craft* are on record, a subsequent lift equal to that test lift may be authorized if absolutely necessary and if all conditions having any influence on the lifting problem are essentially the same as the test conditions. In such cases, due consideration shall be given to the effect of any inherent weakness in the structure of any of its component parts, deterioration, weather conditions, and all other circumstances that might modify the conditions of the record test. During such a lift the area shall be completely cleared of all personnel and of all equipment and material which might be damaged by a failure. In no case shall a lift exceeding the recorded limited-test lift be made without specific authorization from the Naval Facilities Engineering Command.

b. Authorization. The operating crew shall never be permitted to load any weight-handling equipment in excess of its rated lifting capacity, without specific authorization from the officer responsible for the operation of the unit. Every instance of exceeding the rated capacity shall be treated as a special problem and all the conditions involved shall be duly considered. In such cases, decisions as to the safe lifting capacity within the overloads in accordance with paragraph a above shall be made by the public works officer.

15. Load Over Workman. When any load is on the hook, no one shall pass beneath the hook.

16. Fire Extinguishers. All cranes shall be equipped with appropriate fire extinguishers which shall be maintained ready for use.

17. Crane Safety Devices. Safety devices shall not be installed on cranes without prior approval of the Naval Facilities Engineering Command, which will be obtained via the safety division of the appropriate headquarters. See NAVDOCKS P-300 or *Marine Corps Manual,* as appropriate, for detailed instructions on requesting such approval.

MT-PWHD-005326

REDACTED
J-M 83

c. NSTM 9510.203 requires that the test pressure be maintained for a minimum of 15 minutes. For the 150% design hydro, the test pressure should be maintained for at least 15 minutes before the visual examination for structural defects is conducted in order to prevent initial exposure of examining personnel to the dangers resulting from failure.

d. A close visual inspection is conducted during hydrostatic tests to 125% of operating pressure and below to ensure tightness of boiler valves, gaskets, fittings, tube joints, etc.

e. Whenever a hydrostatic test is applied to a boiler, the procedures outlined in NSTM 9510.203 shall be followed.

MT-PWHD-005327

0008 1010 REDACTED J-M 83

18. Damaged Crane

a. Standing Instructions shall include procedures to be followed in case of failure or suspected imminent failure of boom, boom hoist, or other hoist gear. Such Instructions shall provide for clearing the area under the boom, rigging of preventer gear to prevent dropping of a boom, and positive engagement of locking devices, as applicable.

b. In any case of a failure or suspected imminent failure of a crane, one person shall be designated in charge during the application of emergency measures to secure the crane and during the conduct of emergency repairs. He shall direct and witness all actions during the securing of the crane and emergency repairs to guard against collapse of the crane during these operations.

0826. CRAWLER, TRUCK, AND TRACTOR-MOUNTED CRANES

1. **General Precautions.** Pertinent precautions listed in articles 0820-0825 apply to crawler, truck and tractor-mounted cranes.

2. **Care of Equipment**

a. Stowing Tools. Tools and other maintenance items shall be kept in the tool box.

b. Fire Extinguishers. All mobile cranes shall be equipped with approved fire extinguishers which shall be maintained ready for use.

c. Danger of High Winds. A high boom with no load in a high wind shall be avoided; this condition might tip the boom backwards.

d. Striking Boom. Whenever a load strikes the boom or the boom strikes an object, the boom should be lowered immediately and carefully examined for bent or damaged members. A slight bend in the boom structure can cause it to fail and collapse.

e. Moving Capacity Load. No one shall travel nor travel and rotate simultaneously with a near-capacity load. If the travel surface is uneven the machine may upset. When necessary to move a capacity load it should be placed on a truck or railroad car and then unloaded at the new location.

MT-PWHD-005328

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REDACTED
J-M 83

f. Traveling Precautions. When traveling from one weight-handling job to another, the boom shall be set in the boom rest when available, or parallel to the general direction of travel and at an angle to clear any overhead obstruction. With a long boom it will generally be necessary to carry the boom to the rear so that it can be swung when traveling around corners. The boom shall not be raised or lowered while traveling. No crewman shall ever ride under the boom.

3. **Operating Near High Tension Lines.** Crane booms should never be operated near high tension power lines if it can be avoided. If work must be done in their vicinity, effort should first be made to have the power lines de-energized before starting work. If that is not possible, then make sure that at no time the boom or fall cable comes closer than 10 feet to the high tension lines while the crane is operating. Operators should not depend on any chain or other grounding device dragging along the ground to give protection against electrical current discharges through the crane. Such a device is not a safe means for grounding a crane and gives the operator a false sense of security.

The electrocution hazard created when a crane boom touches a power line is an extremely serious one. When a boom or cable does touch a high tension wire, creating a short, the operator should either stay in his position on the machine KEEPING HIS HANDS OFF THE CONTROLS, or JUMP CLEAR of the machine. He should never dismount from the machine by climbing down the side thereby permitting his body to come in contact with the machine and the ground at the same time. He should also warn all ground crews not to touch units in contact with the wire.

4. **Angle of Load.** Loads should be lifted only when lifting cable is in vertical position. Lifting a load with the cable at an angle develops twisting stresses in the boom which can cause buckling. Also the swinging of the load after it is lifted clear off the ground may cause the crane to upset.

5. **Setting Outriggers.** When lifting a critical load, the outriggers shall be set on all sides, since if the load is dropped, the kickback may tip the crane backwards.

6. **Level Footing.** When operating a crawler-type crane over soft or uncertain ground, mats should be used to ensure a level footing. In such places planking, pontoons or outriggers should be used with truck cranes.

7. **Radius Indicators.** Radius indicators and capacity charts shall be provided on all crawler, truck, and tractor-mounted cranes.

8. **Blocking Wheels or Tracks.** Unless parked on level ground brakes shall not be depended on to protect against uncontrolled movements, and blocking shall be used.

0827. LOCOMOTIVE CRANES

1. **General Precautions.** Pertinent precautions in articles 0820 through 0825 apply to locomotive cranes.

2. **Removing Steps and Grabs.** Before placing a locomotive crane in operation at a naval activity all steps and hand grabs, except those necessary for access to the cab, shall be removed. (Note: These steps and hand grabs must be replaced before the crane can be moved over the main line of a railroad.)

3. **Boom at Right Angle to Track.** When making heavy lifts with the boom at right angles to the track, unless the weight of the load is accurately known, the outriggers shall be extended and blocked so as to prevent upsetting.

4. **Crane Derailed.** If a locomotive crane has been derailed, a wrecking frog or car replacer (or its equivalent) should be used to re-rail the crane and it should be hauled back on the track by external power.

5. **Curving and Nonlevel Track.** Locomotive cranes shall not work on a curve, or on any track out of level, without having outriggers thoroughly set in place. A VARIATION OF ONE INCH IN THE LEVEL OF

MT-PWHD-005329

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J-M 83

STANDARD GAGE TRACK MAY REDUCE THE LIFTING CAPACITY OF THIS TYPE OF CRANE APPROXIMATELY 60 TO 80 PERCENT.

6. **Radius Indicators.** Radius indicators and capacity charts shall be provided on all locomotive cranes.

7. **Setting Outriggers.** When lifting a critical load, the outriggers shall be set on all sides, since if the load is dropped, the kickback may tip the crane backwards.

8. **Rail Clamps.** Rail clamps shall be loosely set on parked locomotive cranes; rail clamps shall never be used as a means of resisting overturning when handling capacity loads.

0828. PORTAL, GANTRY, HAMMERHEAD, FLOATING, AND OVERHEAD TRAVELING CRANES

1. **General Precautions.** Pertinent precautions in articles 0820 through 0825 apply to portal, gantry, hammerhead, floating, and overhead traveling cranes.

2. **Leaving Crane Unattended.** Load should never be left on cranes overnight or for a longer period than is absolutely necessary. If the load hook is left hitched to an object and the crane operator has to leave the crane, the switches shall be pulled and tagged with a notice such as "LOAD HITCHED–DO NOT OPERATE."

At any other time the operator leaves the crane, all controllers shall be placed in the "OFF" position, the main switch opened and the brakes set. On portal, floating, and hammerhead cranes the rotate locking devices shall also be set.

3. **Wind Locking Devices.** Whenever a crane is left unattended for more than one hour, or whenever weather conditions require, all wind locking devices shall be set.

4. **Care in Closing Switch.** If the operator starting on duty finds a main or emergency switch open, he shall not close it until he has made sure that no one is on or about the crane. If there is a "MAN WORKING" warning sign on the switch, he shall not remove it unless it was placed there by himself, and he shall not close the switch until the warning sign has been removed by the man placing it there.

5. **Standing Over Turbo-Generator.** Cranes when not in use should not be left standing over a turbo-generator unit.

6. **Changing Operators.** When changing operators on a crane, the change shall always take place ON THE GROUND, NOT IN THE CAB.

7. **Pushing Cranes.** Bumping into runway stops except to correct excessive skew, or into other cranes, shall be avoided. If the operator is ordered to engage with or push other cranes, he shall do so with special care for the safety of persons on or below the cranes, and only after making sure that any persons on the other cranes are aware of what he is doing.

8. **Access Ladders.** Each overhead crane runway shall be equipped with an access ladder at each end of the craneway. Ladders shall be made of steel and if over 20 feet long, have a protective cage extending within 7 feet of the floor. At the top of each ladder, a platform, at least 2 feet by 2 feet, shall be installed where employees may board the crane. Access to crane shall be made from the stationary platform to a loading platform attached to the crane cab at the same level. See also 0835.5.

9. **Limit Switches.** Limit switches shall be tested at the beginning of each shift by "inching" the block into the limit stop.

0829. DERRICKS

1. **General**

a. Load and Radius Indicator. All derricks shall be used in such a manner that no part shall be stressed beyond its safe working strength. They shall have radius indicators and capacity charts.

b. Inspection. Before operation each derrick shall be inspected and all brakes, clutches, frictions, and motions tested daily

1723

MT-PWHD-005330

0008 1013 REDACTED J-M 83

by competent personnel, and a record of all inspections shall be kept at the scene of operations until completion of the job.

c. Experienced Operators. Derricks shall be operated only by experienced workmen.

d. Foot Blocks. The foot block of every derrick shall be solidly supported and firmly secured against movement in any direction. Shores shall be placed against the foot blocks of the derrick to prevent any horizontal movement.

e. Lines and Booms. Loads, load lines, and booms shall not be permitted to strike against scaffolds, objects, or structures.

f. Riding Loads. Workmen shall not be allowed to ride on loads handled by derricks.

g. Walking Under Load. Loads shall not be lifted or swung over the heads of persons and no one shall be permitted to walk under a load.

h. Securing Boom. When work is stopped or when the derrick is not in operation, the boom shall be lowered to a horizontal position or tied in place to prevent wind from blowing it out of control.

i. Reference. Additional information may be obtained from the American Standards Association publication, *Safety Code for Cranes, Derricks, and Hoists,* B30.6 (when available).

2. Breast Derricks

a. Set on Planks. Breast derricks, used principally for setting stone, shall be set on heavy planks—never directly on newly-laid floors.

b. Bracing. Where a breast derrick cannot be guyed from the front or load side, a strut or stiff triangular brace shall be fastened to the back of the derrick to prevent it from falling backwards should the pull of the load be changed to other than vertical.

c. Guarding Gears. All gears shall be effectively guarded and a ratchet and pawl which will hold the load at any desired height shall be provided.

d. Handle of Lever. A hole shall be drilled in each end of the gear shaft outside the operating lever, and a cotter pin placed in each hole to prevent the handle from slipping or working off the shaft.

e. Lowering Load With Brake. Crank handles shall be removed from the crankshaft before any load is lowered by means of the brake and they shall be kept removed as long as the brake is being so used.

3. Pipe Laying Derricks

a. Guards. All gear wheels and blocks shall be effectively guarded.

b. Securing Cable at Night. At night the rope or cable shall be wound up until the blocks meet, and the drums shall be chained and locked.

c. Top Heavy Load. When motor truck and crawler derricks are used, positive means shall be taken to prevent the load from overturning the supporting vehicle.

4. Gin Poles

a. Guying. Gin poles shall be properly guyed according to the type used.

b. Anchoring. Guys shall be attached to "dead men" or other type of approved anchors, or some permanent stable object.

c. Spacing of Anchors. When the guy lines are anchored to a permanent structure the anchors shall be located at least one-half the height of the pole from its base, and when "dead men" are used, the distance from the base shall be at least one and one-half times the height of the pole.

5. Stiff-Leg Derricks. The weighting and anchoring of a stiff-leg derrick shall be such as to assure stability of the derrick. The material for weighting should be enclosed in well-constructed boxes.

6. Guy Derricks

a. Cables. Wherever possible, the top of the mast on guy derricks shall be steadied by not less than six cables spaced so as to make the angles between adjacent cables approximately equal.

b. Eyes at Masthead. On guy derricks, eyes shall be formed in the guys at the masthead end by the addition of properly attached socket fittings. The use of U clamps on the short end of a wire rope for making fastenings is not recommended.

1724

MT-PWHD-005331

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J-M 83

c. Fall Line Vertical. The fall line shall be vertical before a lift is made.

0830. HOISTS AND ELEVATORS

1. General

a. Inspection. All hoisting equipment shall be periodically inspected and tested, at least monthly, and brakes, gears, and operating levers maintained in good working order. Any hoist that becomes defective or any hoist that is not in good working order shall be plainly tagged to this effect and shall not be used until repaired and tested.

b. Load Capacity. Before any hoist is placed in operation, the maximum load capacity shall be determined and, under no circumstances, shall the hoist be used for lifting loads above that capacity. Load capacity of hoisting apparatus shall be prominently displayed.

c. Reliable Operators. Hoists or elevators for lifting workmen or materials shall be operated only by competent and reliable men.

d. Hatchway, Hoist, or Tower. Men shall not work in or on a hatchway or hoist tower when the hoist is being operated.

e. Signals

(1) Kinds Permitted. A standard signal system shall be used on all hoists. Whistle signals on hoisting work are dangerous, and their use is not recommended. Hand signals are more reliable where the operator can always see the signalman; but a mechanical or electrical bell at the engine is much more satisfactory.

(2) Hoist signalman. Hoist signals shall be given only by the assigned signalman.

(3) Code posted. The signal code shall be posted near the signal device at each work level, and it must be kept clearly visible.

f. Keep Clear of Shaftway. While waiting for the hoist, workmen shall never put their heads into the shaftway to see where the hoist is. They can tell whether or not the hoist is moving by watching the hoist cable; they can note its location from the loading platform.

g. Locking Device for Cage or Platform. When it is necessary for workmen to enter the cage or platform of any material hoist or elevator other than at the bottom landing, some locking device must be provided to prevent the cage or platform from being lowered or raised while the workmen are entering or leaving the cage.

h. Electrical Signaling Device. If an electrical signaling device is placed on the cage and this is the only method used to signal the hoisting operator the locking device may be omitted.

i. Workmen's Hoists. Hoists used to raise and lower workmen shall be constructed and used in accordance with ASA A10.4-1963 *Safety Requirements for Workmen's Hoists.*

2. Inside Material-Hoist Shaftways

a. To Be Enclosed. All material-hoist shaftways erected inside buildings should be enclosed tightly for their entire height. When this is not practicable, the sides of the shaftways not used for entrances shall be enclosed on each floor to a height of at least 8 feet with wire netting formed of not less than No. 16 U. S. gage wire, one and one-half inch mesh, or enclosed with wooden slats spaced vertically not more than 1½ inches apart, with a toe board placed around all sides except at the entrance.

b. Adjacent Shaftways. When two material hoist shaftways are erected side by side, similar protection shall be placed between them, except where enclosed cabs are installed.

c. Bars and Gates. All entrances into the shaftway shall be protected by hinged or pivoted bars or by gates.

d. Guide Rails Rigid. The guide rails of all hoists shall be kept rigid and in perfect alignment at all times.

e. Construction of Guide Rails. The guide rails shall be of sound lumber or steel of adequate uniform size to provide a firm track.

f. Sheave Beams. Overhead sheave beams and their supports shall be of good sound timber or steel of adequate strength and stiffness.

1725

MT-PWHD-005332

0008 1015
REDACTED
J-M 83

g. Protection of Hoists. Protective covering of planking or heavy wire netting shall be provided above all hoists to prevent objects falling down the shaftway.

3. Material-Hoist Platforms

a. Safety Factor. Material-hoist platforms shall be substantially constructed and of sufficient strength with a safety factor of five for the rated load and capacity.

b. Protection of Crosshead. Overhead protective covering of planking or heavy wire mesh shall be provided on the crosshead of every material-hoist platform to prevent objects falling on the workmen when loading or unloading the hoist.

c. Hinged Sections. The protection on the crosshead shall be made in sections and each section hinged, so they may be raised when hoisting long material.

d. Hoisting Long Material. When using a hoist for long material, the several pieces of the material shall be securely fastened together and made fast to the hoist so that no part of the load can fall or project beyond the sides of the hoist and get caught.

e. Blocking. Suitable blocking and cleats shall be provided on all platforms when wheelbarrows or other rolling equipment are transported to hold them securely in place.

f. Enclosed Sides. The platform of every hoist shall be enclosed on the sides not used for loading or unloading, with toe boards and a heavy wire screen enclosure formed of No. 16 U. S. gage wire, one and one-half inch mesh.

4. Outside Hoisting Tower

a. Construction. All material-hoist towers built of wood erected outside of buildings shall be constructed of No. 1 common Douglas fir or equivalent except for cab or bucket guides, which shall be clear, straight-grained Douglas fir or equivalent, free from knots or other defects. Towers should be plumb and square at corners.

b. Wooden Members. Wooden members for the corner posts may be built up of 2-inch laminated material. The wooden members, such as splice pads, braces, etc., may be bolted or nailed. No bolt less than ½ inch in diameter shall be used.

c. Strength. Towers other than wooden towers may be used if equivalent strength is provided.

d. Cross Bracing. The diagonal cross bracing shall be placed on each of the four sides of tower and between horizontal cross ties except at loading and unloading platforms, in which case some other bracing of equivalent strength shall be provided.

e. Removal of Braces. Not more than two diagonal braces shall be removed from any panel point in the tower and never from two consecutive panels.

f. Foundations. Foundations for hoist towers shall be sufficiently large to spread the hoist load so that it will not exceed the safe bearing capacity of the soil on which it stands. Foundations shall be level.

g. Splicing. All splices in posts shall be not less than 2 inches in thickness, 4 feet long, and shall be spiked or bolted to at least 2 adjacent sides of the posts. All splices shall be staggered.

h. Ladder. A strong ladder, securely fastened to the tower, shall extend its entire height. (See article 0835.5)

i. Anchoring. Hoist towers shall be securely guyed and well anchored.

j. Securing Guys. The guys shall be securely clamped to "dead men" of sufficient size, and well buried unless adequate building anchorages are available.

k. Platforms. Platforms of ample size and strength, with railings and toe boards, shall be built at each level where men work.

l. Enclosed Sides. Hoist towers shall be enclosed on all sides for their entire height with a wire screen enclosure formed of No. 16 U. S. gage wire and one and one-half inch mesh securely fastened to the tower structure. Properly protected openings shall be formed on each floor level.

5. Hoisting Engines

a. Specifications. All gearing on hoisting engines shall be enclosed or suitably guarded. Steam piping shall be insulated and, if electrical equipment is used, it shall be effectively grounded.

1726

MT-PWHD-005333

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REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 0830

Subj: Workmen's Hoists

Ref: (a) NAVMAT P-5100, Article 0830

1. PURPOSE. To supplement reference (a) with additional instructions concerning workmen's hoists.

2. GENERAL. Workmen hoists are available for Drydocks 1, 2, and 3. The hoists are designed and intended to be used as a rapid and expeditious means of transporting personnel and their hand tools between ground level and the floor of the drydocks. Heavy equipment and other tools, including certain portable tools, are not to be transported on the workmen hoists. Such equipment will continue to be transported via existing methods.

3. REMOVAL AND REINSTALLATION

a. The Production Department (Code 970) will:

(1) Take action to remove or replace workmen hoists from drydocks when requested by cognizant code and directed by authorizing job order.

(2) Take action to make electrical hookup or disconnection of workmen hoists when requested by cognizant code and directed by authorizing job order with assistance of Shop 03.

b. Repair Division (Code 340) will: Insure the removal/reinstallation of workmen hoists will be in concert with docking/undocking schedules.

c. Availability Planning Division (Code 210) will: Include in the existing docking/undocking job order, specifications and manhour allowances for cognizant Production Shops for the removal/reinstallation and electrical hookup of workmen hoists.

d. Public Works Department (Code 903) will: Notify Code 440 and Naval Station Public Works Department (Code 156) when notice of a docking is received.

e. Public Works Department (Code 440) will: Send a representative who, with assistance from the Naval Station Public Works Department (Code 156), shall test and inspect the hoist.

4. OPERATING SAFETY PRECAUTIONS. The following safety precautions pertain to workmen hoists.

a. Personnel using the workmen hoists will be allowed to transport only those hand tools which may be contained in a Shipyard regulation personal tool box.

REDACTED
J-M 83

b. Employees will not be allowed to transport material on workmen hoists.

c. Doors or gates to cages will be firmly secured after each use so that hoists may respond to a call signal. Failure to properly close doors renders hoists inoperable.

d. All operating instructions and safety regulations posted inside the cages of hoists must be adhered to during operations.

MT PWHD 005035

0008 1018 REDACTED J-M 83

b. Electric Motors. Where electric motors are used, unauthorized persons shall not tamper in any way with the electrical apparatus, and all repairs and adjustments shall be made by competent electricians. (See Chapter 15.)

c. Protection from Weather. The hoisting engine and the operator shall be protected against the weather and from falling objects by a substantial covering.

d. Inspection. All hoisting equipment shall be frequently inspected, and brakes, gears, and operating levers kept in good working condition.

e. Guards for Cables. Guards shall be provided where necessary to prevent persons coming in contact with hoisting cables.

f. Grease on Brake Drums. Brake drums shall be kept free of oil or grease or any substance which reduces their efficiency.

g. Securing Load. A pawl or dog shall be used in addition to the brake to hold the load when it is to be suspended for any considerable length of time.

h. In Public Places. Hoisting engines should not be set up in the street, but if they must be so located they shall be completely housed-in for the protection of the public, the engine, and the operator.

6. Cables and Sheaves

a. Specifications. Hoisting cable shall not be less than plow steel grade and shall be so constructed of wires and strands of wires as to be equal in flexibility to standard plow steel hoisting rope composed of 6 strands of 19 wires each. No hoisting cable less than 1/2 inch in diameter shall be used except for small winches as used on gin poles, etc., where 3/8-inch cable may be used.

b. Fastenings. Cable fastenings shall be substantially and securely made and maintained. Only properly attached sockets should be used for new wire rope fastenings. (See article 0821.2)

c. Worn Sheaves. Sheaves that have become worn, chipped, or the grooves corrugated should not be used, as they will injure the rope. (See 0825 and 0821)

d. Cast Iron Sheaves. Cast iron sheaves shall be tested with a hammer before using to make sure they are not cracked or broken. Cast steel sheaves are preferred.

7. Concrete Bucket Towers

a. Standards. Concrete bucket towers shall conform to the standards set for material hoists and towers, and shall have similar protection and shaftways.

b. Platforms and Runway. Openings with platforms shall be formed at each floor level, and the runway leading to the tower shall be guarded with railing and toe guards.

c. Riding Bucket. Workmen shall never ride in the bucket.

d. Hoist Pit. The hoist pit shall be kept drained. Workmen shall not enter the pit to make repairs without first making sure that the bucket is resting on the blocking.

0831. PAVING AND CONCRETE EQUIPMENT

1. Rock Crushers and Batching Plants

a. Platforms and Ladders. Proper working platforms and safe ladders adequately equipped with guardrails shall be provided on each rock crusher and batcher.

b. Falling Rocks. Ground crews shall be protected from falling rocks or other material that may be dropped. Protective hats shall be worn by these workmen.

c. Dust Protection. Equipment for protection against dust shall be provided for all cement handlers, and this equipment must be worn wherever applicable.

d. Power Lines. Care must be taken to make sure that high portions of this equipment do not come in contact with nearby electric power lines.

2. Concrete Mixers

a. Skip

(1) Loader Cables. Frequent inspection of the skip loader cables and brakes shall be made to prevent possible injury from a falling skip.

(2) Blocking. Whenever it is necessary to work under a skip, the skip must be solidly blocked into position to prevent it from falling should the brake fail or be released.

b. Surrounding Area. The area around a mixing plant shall always be kept clean;

1729

MT-PWHD-005336

0008 1019

REDACTED
J-M 83

waste material shall not be allowed to accumulate near it.

c. **Dust Protection.** Dust protection shall be provided for all personnel working with cement or cement sacks.

d. **Hopper.** If an elevating hopper is used, the machine operator shall always see that all workmen are out of danger before the hopper is lowered. The hopper itself should be guarded by barriers on the side to prevent anyone walking under it while it is being lowered.

e. **Cleaning Drum.** The switches shall be opened, the throttles closed, and the operating mechanism of mixers locked in the "Off" position when men are cleaning inside the drum.

f. **Watchman and Warning Signs.** If possible, a flagman or watchman should always be stationed near a mixer when batching trucks are backing up to it, and he should use a whistle to warn all workmen who are in the danger zone. If such a watchman is not available, "DANGER–KEEP AWAY" signs should be placed conspicuously on each side of the mixer to warn the workmen.

3. **Asphalt Plants**

a. **Fire Prevention.** Hot mix plants shall have adequate safeguards for preventing fires. Asphalt spreaders shall be properly maintained so as to prevent injury to the operators and to prevent fires.

b. **Guards.** Mixing plants shall have suitable guards on all moving parts that might jeopardize the safety of the operators or the maintenance crews. Safety guards against the spilling of hot asphalt on operating personnel should also be employed.

c. **Protective Apparel.** Workmen handling tar or asphalt shall wear gloves, goggles, safety shoes and suitable heavy clothing to prevent burns from bubbling or splashing hot material. Trousers should be fastened tightly around the ankles.

d. **Ventilation.** Adequate ventilation shall be provided to maintain fumes from hot asphalt, tar, oils, etc., at safe concentrations for personnel.

e. **Traffic Control.** Proper traffic control shall be maintained at all times around the mixing and batching plant when workmen or trucks are working in the area.

4. **Pavers**

a. **Skip Guards.** Wherever feasible, road building mixers should be equipped with a guard to prevent workmen from walking under the skip when it is raised to the charging position. This skip guard should be serviced regularly and never allowed to get out of order. It should be taken off the machine for repairs only when the mixer is idle.

b. **Load Warning Bells.** Pavers should be equipped with a load warning bell, which should always be used when the paver is being moved ahead or when the bucket is run out among the puddlers and the men placing steel and joints.

c. **Backing Truck.** The paver skip signalman must be active and alert. He should always warn men working on the subgrade when a truck is backing into a skip, and he should signal the truck driver when all men are in the clear.

d. **Waste Material.** Waste material shall not be allowed to accumulate around pavers.

e. **Cables and Sheaves.** Cables and sheaves of pavers shall be inspected daily.

f. **Warning Signs.** Plenty of "ROAD CLOSED" warning signs, used separately or placed together to form a long barricade, should be employed where necessary.

5. **Belt Conveyors**

a. **Guards.** Adequate safeguards shall be provided at all points along every conveyor.

b. **Making Adjustments.** The conveyor shall always be shut down before any maintenance or adjustments are attempted.

c. **Locking Controls During Repairs.** When any repair is being made remote from the controls of the paver, adequate warning signs or locking devices shall be placed, and these shall be removed only by the repairman himself after completion of the job.

1730

MT-PWHD-005337

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0835. LADDERS

1. Specifications

a. Safety Code. Commercial ladders shall comply with the specifications currently in use by the Department of the Navy.

b. Defective Parts. Ladders should be inspected at frequent regular intervals. Ladders with weakened, broken, or missing treads, rungs, or cleats, or broken or "splintered" side rails shall not be used.

c. Coating. Ladders should be kept coated with a clear shellac or other transparent material, or treated with linseed oil. Painting with opaque paint is forbidden.

d. For Two-Way Traffic

(1) Two ladders. Separate ladders for ascending and descending shall be provided in building construction of more than 2 stories in height, or where traffic is heavy.

(2) Single ladders. Where a ladder is installed wide enough to permit traffic in both directions at the same time, a center rail shall be provided. One side of the ladder should be plainly marked "up" and the other side "down".

e. Guardrails. Ladders used in passageways, driveways, or public thoroughfares shall be guarded by barricades (guardrails). Doors which open adjacent to portable ladders should be locked or otherwise blocked or guarded while the ladder remains in use.

2. **Position**

a. Support. Ladders shall be placed so that the rails have a secure footing and a substantial support at or near the top.

b. Stable Position. Ladders shall not be placed against sash, window panes, or unstable supports such as loose boxes or barrels. The use of ladders during a storm or in a high wind shall be avoided unless necessary, in which case the ladder shall be securely lashed in position.

c. Against Window Frames. If a ladder is to be placed against a window frame, a board shall first be spiked across the side rails at the top.

d. In Front of Door. A ladder shall never be placed in front of a door opening toward the ladder unless the door is locked, or otherwise blocked, barricaded, or guarded.

e. In Elevator Shafts. Ladders shall not be placed or used in elevator shafts or hoistways. Should such a procedure be necessary, the ladders shall be protected from objects falling from operations at higher elevations in or adjoining the shaft.

f. Standing Outside. Ladders shall not be left standing, especially on the outside, for long periods of time unless securely anchored at both top and bottom.

g. Lowering Ladders. Ladders should be handled carefully when being lowered. They should not be allowed to drop on their sides or to fall heavily endwise on one rail.

h. Portable Metal Ladders

(1) Near Electric Circuits. Ladders used near live electric circuits should not have metal rungs, braces, trusses, or struts, because of the danger of short circuits or accidental contact with live wires.

(2) Near Electrical Equipment. Until such time as satisfactory specification for portable metal ladders approved by the Navy Department is issued, the use of such ladders is not recommended. These ladders shall not be used within four feet of any electrical wiring or equipment. All portable metal ladders shall be marked with signs or decals reading CAUTION–DO NOT USE NEAR ELECTRICAL EQUIPMENT. Such signs shall be placed on the inside of side rails between the third and fourth rungs.

3. **Use**

a. Cause of Accidents. The use of ladders where scaffolds, platforms, or other substantial working levels should have been provided, has resulted in many serious accidents. Work performed from ladders should be kept to a minimum.

b. Facing Ladder. When ascending or descending a ladder, the user shall always face the ladder.

1731

MT-PWHD-005338

REDACTED
J-M 83

c. Free Hands. No one should go up or down a ladder without the free use of both hands. If handling material, a rope should be used.

d. Running. No one shall run up or down a ladder, or slide down a ladder, at any time.

e. Grease On Shoes. Before attempting to climb a ladder, workmen should remove oil or grease from the soles of their shoes.

f. Safety Belt. When doing maintenance work above the ground, workmen should always use a safety belt, with a lifeline tied off long enough for necessary movement, but short enough to prevent falls.

4. Single Portable Ladders

a. Definition. A single portable ladder is a ladder of one section which may be used at various locations.

b. Length. Single portable ladders over 30 feet in length shall not be used.

c. Angle. When a portable ladder is placed against the wall or other fixed object, unless the ladder is securely fastened or a man is holding it, the base should be one-fourth the ladder length from the vertical plane of the top support. Where the rails extend above the top landing, ladder length to the top support only is considered.

d. Back Clearance. The clearance back of a ladder should always be sufficient to obtain a secure foothold on the rungs. Clearance of at least 6 inches is recommended.

e. Front Clearance. The clearance space in front of the ladder should be such that it will not be necessary to assume a cramped or unnatural position when climbing. Front clearance of at least 30 inches is recommended.

f. Nonslipping Base. Portable ladders, where used on smooth floors or sloping surfaces should be equipped with nonslipping bases, or otherwise secured to prevent displacement.

g. Splicing. Single ladders which were not constructed to be used as sectional ladders should not be spliced together to form a longer ladder, unless such splicing together will provide and maintain the strength and rigidity required for a longer ladder.

5. Fixed Ladders

a. Definition. A fixed ladder is a ladder fastened to a structure in a permanent position.

b. Fastenings. Fixed ladders shall be securely held in place by top, bottom, and intermediate fastenings as required.

c. Clearance. Vertical ladders shall have a clear distance of at least 6-1/2 inches from back of the rung or cleat to the nearest permanent object. Climbing clearance should be at least 30 inches from face of rungs to the nearest obstruction.

d. Sloping Ladders. Sloping ladders which require climbing on the under side of the ladder shall not be used.

e. Landing Platforms. Rails of ladders fixed to top landings should extend a distance of at least 36 inches above the landing. Rungs above the landing shall be omitted when it is necessary to pass through the ladder. Landing platforms shall be provided where a person must step a greater distance than 14 inches from ladder to roof, tank, etc.

f. Platform Intervals. Landing platforms shall be provided for fixed ladders exceeding 30 feet in length at intervals of 30 feet or fraction thereof. The ladder sections shall be offset each from the other and connected by a landing platform. The top rung of any section of fixed ladder shall be at the level of or above the adjacent landing platform. On stacks or tanks the offset provision need not apply.

g. Metal Cages. Metal cages extending from a point 7 feet above the base should be provided for all permanently fixed external and internal ladders more than 20 feet in height where such ladders are employed in regular service. Metal cages are not required where a ladder climbing safety device is provided in accordance with article 1545.5.

6. Extension Ladders

a. Definition. An extension ladder is a ladder consisting of two or more sections

MT-PWHD-005339

REDACTED
J-M 83

traveling in guides or brackets so arranged that it may be adjusted to different lengths.

b. **Specifications.** Extension ladders shall not have more than two sliding sections. No extension ladder exceeding 60 feet in length when extended shall be used.

c. **Angle.** Extension ladders should be raised vertically, locked, and then placed at the same angle as single ladders. (See article 0835.4c.)

d. **Overlapping Portions.** Extension ladders shall be so constructed that, when locked in any position, rungs of the overlapping portions of each section will be opposite each other and of strength equal to a ladder with continuous side rails.

e. **Extent of Overlap.** A lap of 3 feet shall be maintained for ladders up to 38 feet of extension length; 4 feet for ladders 38 to 44 feet; and 5 feet of lap for ladders with 44 feet of extension length.

7. Stepladders

a. **Definition.** A stepladder is a ladder having treads and so constructed as to be self-supporting.

b. **Length.** Stepladders longer than 16 feet shall not be used.

c. **Fully Open.** Stepladders shall be fully opened before anyone steps on them.

d. **Used as Platform.** A stepladder shall not be used as a working platform.

e. **Tools.** Tools shall not be left on top of stepladders, unless tool holders are provided.

f. **Strenuous Action.** Stepladders shall not be used when strenuous action on the part of the workmen is required. Under those circumstances there is danger of overturning the ladder.

8. Sectional Ladders

a. **Definition.** A sectional ladder is a ladder consisting of two or more sections so constructed that the sections, when combined, will function as a single ladder.

b. **Specifications**

(1) Sectional ladders longer than 30 feet shall not be used.

(2) The bottom and intermediate sections of sectional ladders should not exceed a length of 6-1/2 feet, and the top section should not exceed a length of 9 feet.

(3) The connection joint of sectional ladders shall not be less than 1 foot and shall fit closely without binding or unnecessary play.

c. **Angle.** Sectional ladders shall be placed for use at the same angle as single ladders. (See article 0835.4c.)

9. Trestle Ladders and Extension Trestle Ladders

a. **Definitions**

(1) Trestle Ladder. One consisting of two single ladders hinged at the top to form equal angles.

(2) Extension Trestle Ladder. One consisting of a trestle ladder with an additional single ladder which is adjustable vertically and provided with a lock to keep it in place.

b. **Dimensions Permissible.** Trestle ladders and the base sections of extension trestle ladders shall be limited to 20 feet in height. The extension section of extension trestle ladders shall not exceed 20 feet.

c. **Support for Scaffold.** Trestle and extension trestle ladders shall be so spread that the width of the trestle at the bottom, inside to inside, is equal to or greater than 5-1/2 inches per foot of ladder length.

d. **Locking Device.** The locking device or spreader used to hold the front and back sections in an open position must always be locked in place when using the extension ladder. Also, the locking device for securing the extension section to the base must be utilized.

0836. SCAFFOLDS

1. General

a. **Definitions**

(1) Scaffold. The term "scaffold" shall mean any temporarily located elevated platform used for supporting workmen and materials in the course of any and all types of construction work, including excavation, construction, erection, alteration, demolition, maintenance, repair, and all operations in connection therewith. Suggested methods of design and construction of the various types

MT-PWHD-005340

0008 1023
REDACTED
J-M 83

of scaffolds are illustrated at the end of this section.

(2) Barge (Pontoon) Scaffold. The term "barge" or "pontoon" scaffold shall mean a scaffold of the independent pole type built upon and secured to a barge or pontoon for work on the hull of ships afloat.

(3) Boatswain's Chair. The term "boatswain's chair," illustrated in Figure 7, shall mean a seat to support a person in a sitting position at an elevation.

(4) Bricklayer's Square Scaffold. A "bricklayer's square scaffold," illustrated in Figure 6, is a platform composed of planks supported on built-up squares, secured to each other by diagonal bracing.

(5) Carpenter's Bracket Scaffold. A "carpenter's bracket scaffold," illustrated in Figure 9, is a platform composed of planks and supported on triangular-brace brackets secured to the side of the building.

(6) Crawling Board or Chicken Ladders. These terms shall mean a plank or board to which cleats are nailed at equal intervals. This board is used for crawling up or down steep inclines.

(7) Float (Ship) Scaffold. This term shall mean a scaffold hung from an overhead support by means of ropes and consisting of a platform of planks fastened together by a diagonal board underneath the platform, which rests upon and is securely fastened to two parallel plank bearers at right angles to the span.

(8) Horse Scaffold. A "horse scaffold," illustrated in Figure 5, is a platform which is supported by horses.

(9) Independent Pole Scaffold. An "independent pole scaffold," illustrated in Figures 1 and 2, is supported from the base by a double row of uprights and is independent of support from the walls. A pole scaffold is constructed of poles, ledgers, bearers, and diagonal bracing. (An independent pole scaffold may also be referred to as a build-up scaffold.)

(10) Ladder-Jack Scaffold. This term shall mean a scaffold, the platform of which is supported by jacks attached to ladders (illustrated in Figure 9).

(11) Needle-Beam Scaffold. A "needle-beam scaffold," illustrated in Figure 4, consists of a plank platform resting on 2 parallel horizontal beams, called "needle beams", which are supported by ropes from overhead.

(12) Outrigger Scaffold. This term shall mean a scaffold, the platform of which is supported by outriggers or thrustouts from or through the wall of the building, with the inner end secured inside the building. (See Figure 10 for illustration.)

(13) Plasterer's Inside Scaffold. This term shall mean a scaffold constructed for light work inside a building, the platform of which is supported by trestles, ladders, or a light-duty pole scaffold.

(14) Roofing Bracket. A "roofing bracket" has sharp points that are driven into the roof to keep the bracket from slipping. It should be supported by means of ropes over the ridge secured to some permanent object on the far side of the roof, or by a hook over the ridge pole.

(15) Single Pole Scaffold. A "single pole scaffold," illustrated in Figure 3, is a platform resting on putlogs, the outer ends of which are supported on ledgers secured to a single row of uprights and the inner ends supported on or in a wall.

(16) Suspended Scaffold. A "suspended scaffold" is supported from overhead. The platform is supported at more than two points by steel wire cables suspended from outriggers which are anchored to the steel or concrete frame of the building. This scaffold is equipped with a hoisting machine so that the platform can be raised or lowered.

(17) Suspended Stage Platforms. A "suspended stage platform" is suspended from the hook of a crane or derrick or other approved mechanical weight-lifting device.

(18) Swinging Scaffold. A "swinging scaffold," illustrated in Figure 7, is a platform supported by stirrups at not more than two points. Stirrups are suspended from overhead supports to permit raising or lowering the scaffold to the required work level.

(19) Window Jack Scaffold. This term shall mean a platform which is sup-

1734

MT-PWHD-005341

REDACTED

J-M 83

LBNS SAFETY SUPPLEMENT NO. 0836

Subj: Scaffolds

Ref: (a) NAVMAT P-5100, Article 0836

1. PURPOSE. To supplement reference (a) with additional instructions concerning the erection, alteration, dismantling, and maintenance of scaffolds.

2. POLICY. All scaffolds will be erected in accordance with reference (a). The erection, maintenance, alteration, and dismantling of scaffolds over four feet in height is the responsibility of Shop 64 and will be performed only by qualified Shop 64 personnel. Exceptions to this are jobs of the Public Works Department or private contractors. In such cases, scaffolds may be constructed by Public Works Department or private contractor employees provided they are qualified. Any scaffolds constructed within the Shipyard by a private contractor must be in compliance with the standards of the Occupational Safety and Health Administration.

a. Access. Scaffolding and other work platforms shall not be used until a safe means of access has been installed in accordance with this chapter.

b. Standard Guard Railing. Standard guard railings are mandatory along the exposed edges of wall or deck openings and working levels of all scaffolds and elevated platforms more than 5 feet in height, except as otherwise exempted (see Article 0836.1.a (27) for detailed demensions).

c. Toe Boards. A standard toeboard is a vertical barrier at platform level erected around the exposed edges of a scaffold platform to prevent materials from falling off. Toeboards shall be installed on the working levels of all stagings and built-up scaffolds except those used for abrasive blasting and painting of the hulls of ships in drydock. Gaps in toeboards are permitted at access openings to eliminate a tripping hazard (see Article 0836.1.a (28) for detailed dimensions).

d. Inspections. All scaffolds, platforms, floats, and temporary structures must be inspected by the supervisor in charge of the erection or relocation before being placed into service to insure they are safe for the intended use and secured against movement.

MT-PWHD-005342

REDACTED
J-M 83

e. Work in Elevated Areas. Elevated work, for which scaffolding or related equipment is required, shall not be performed from makeshift work platforms such as buckets, boxes, crates, drums, etc., or from improvised staging. No horses and stools will be used on scaffolds unless modified by boxing in the lower extremities of the legs to provide a greater bearing surface.

f. Scaffold Requests After Normal Working Hours. Should it become necessary to construct or alter scaffolding outside of normal working hours, such services will be requested from the Service Group Security Watch and performed under their direction.

MT-PWHD-005343

REDACTED
J-M 83

ported by a jack or thrustout which passes through a window opening. (See Figure 9 for illustration.)

(20) Brace. This term shall mean a tie that holds one point in a fixed position with respect to another point. Bracing is a system of braces that prevents distortion of a structure such as a scaffold.

(21) Heavy Duty Scaffold. This term shall mean a scaffold designed and constructed to carry a working load of 75 pounds per square foot which is required for stone masonry work, construction work involving steel members, or similar construction. Such scaffolds support, in addition to the workmen, a supply of heavy material.

(22) Ledger (Stringer). A "ledger" is a scaffold member which extends horizontally from upright to upright at right angles to the putlogs. The ledgers support the putlogs and form a tie between the uprights, and are a part of the scaffold bracing. (Ledgers which do not support putlogs are called stringers.)

(23) Light Duty Scaffold. This term shall mean a scaffold designed and constructed to carry a working load of 25 pounds per square foot; such a scaffold is intended for the use of carpenters, painters, or others of a similar trade, and supports no load other than the workmen and a minimum of lightweight material.

(24) Putlogs (Bearers). A putlog is a scaffold member upon which the platform rests. In a single pole scaffold the outer end of the putlog rests on a ledger and the inner end rests on or in a wall. In an independent-pole scaffold, each end of the bearer rests on a ledger.

(25) Protective Covering. A protective covering is an overhead protection consisting of a roof of lumber, heavy wire screen, or heavy canvas, depending upon the hazard involved. Coverings are used to protect against falling material. Covering shall extend a sufficient distance beyond the edge of the scaffold to catch any falling material. The netting of screen shall be not less than No. 18 gage, U. S. Standard Wire, with a mesh not to exceed one-half inch. Screens of heavier wire or smaller mesh shall be used where conditions are such that the No. 18 gage wire or one-half inch mesh will not furnish adequate protection.

(26) Side Screen. A "side screen" is a screen paneling from platform to intermediate railing or from platform to the top railing. Screening is formed of No. 16 U. S. gage wire with one-half inch mesh. Screen is used for the purpose of preventing materials, loose or piled, from falling off scaffolds.

(27) Standard Guard Railing. "Standard guardrailing" is a vertical barrier erected along the exposed sides of scaffolds. The barrier consists of a top rail, an intermediate rail, and uprights having a vertical height of 42 inches measured from the upper surface of the top rail to the platform. The intermediate rail should be located approximately half way between the top rail and the platform. The intermediate rail may be of fiber or steel rope, pulled up taut and of strength equivalent to that of a wooden rail. The top guardrail shall be of dressed lumber, straight-grained and not less than 1-7/8 inch by 2-7/8 inches in size.

(28) Standard Toe Board. A "standard toe board" is a vertical barrier at platform level, erected along the exposed edges of a scaffold platform to prevent materials falling off. The height of toe board shall be at least nominal 6 inches.

(29) Square. A "square" is a frame structure built up of vertical and horizontal members and braces which, when used in pairs and set up and braced longitudinally, provides a support for a working platform. (See Figure 6 for illustration.)

b. Miscellaneous Precautions

(1) Use of Scaffolds. Scaffolds constructed in accordance with Navy requirements should be provided for personnel engaged in work that cannot be done safely from the ground or from other solid construction, except for such short-period work as can be done safely from securely placed ladders.

(2) Makeshift Scaffolds. Scaffolds of a type suitable for the work shall be pro-

1737

MT-PWHD-005344

REDACTED
J-H 83

vided for the safety of the personnel performing such work. The use of "shore", "lean-to", or other makeshift scaffolds is prohibited.

(3) Maintenance. All scaffolds and scaffold equipment mentioned or described herein shall be maintained in a safe condition and shall not be altered or disturbed while in use. Personnel shall not be allowed to use damaged or weakened scaffolds.

(4) Inspection. Structural members, support ropes, and scaffold equipment shall be inspected daily before work is started.

(5) Protective Covering. When men are working on a scaffold with other workmen engaged directly above, either the scaffold shall have an overhead protective covering or the workers on the lower scaffold must wear approved protective hats. Where the upper working level is no more than 12 feet above the lower, hard hats worn by workers on the lower level will satisfy this requirement.

(6) Scaffolds Over Passageways. Employees should not be required to work underneath a scaffold. Scaffolds erected over passageways, thoroughfares, or locations where employees are working shall be provided with wide screens and a protective covering.

(7) Access. A safe means of access shall be provided to all scaffolds by means of standard stairs or fixed ladders.

(8) Construction and Dismantling. The erection, alteration, and dismantling of scaffolds shall be done only under the supervision of men experienced in scaffold work.

(9) Nails. When dismantling the scaffolding, all nails shall be immediately withdrawn from the lumber and safely discarded.

(10) Sway Bracing. Scaffolds shall be secured against swaying.

(11) Weather Restrictions

(a) Wind. Employees shall not be permitted to work on a scaffold during a storm or high wind.

(b) Ice and Snow. Employees shall not be permitted on scaffolds which are covered with ice or snow. Clinging ice shall be removed from all guardrails, and the planking sanded or otherwise protected against slipping. Platform planking should not be turned over if it is covered with sleet, snow, or ice.

(12) Improper Support. Unstable objects, such as barrels, boxes, loose tile blocks, and piles of bricks shall not be used for the support of scaffold planking.

(13) Used for Storage. No scaffold shall be used for the storage of materials, except that required for the immediate needs of the job.

(14) Material on Scaffold. Tools, equipment, material, and rubbish shall not be allowed to accumulate on scaffolds to a point where the safe movement of employees is jeopardized.

(15) Containers for Tools. Tools should be placed in containers to prevent their being knocked off. Containers should be secured to the scaffold by rope.

(16) Bracing for Load. Scaffolds shall not be used as loading or landing platforms for material unless they have first been sufficiently braced and reinforced for such purposes.

(17) Use of Clamps. When heavy loads, shocks, or vibrations must be resisted, bolted or patented clamp connections shall be used.

(18) Raising or Lowering Objects. Throwing or dropping objects or tools from scaffolds is prohibited. Hand lines shall be used for raising or lowering objects when they cannot be reached easily and safely by hand. Jumping by persons or throwing material upon a scaffold platform is prohibited.

(19) Painting. Scaffolds shall not be painted since painting conceals defects which otherwise would be apparent.

c. Safe Loads

(1) Specifications. Platforms and all supporting elements of scaffolds, whether of wood or any other material, shall be designed to support a minimum uniform load per square foot as follows:

MT-PWHD-005345

0008 1028
REDACTED
J-M 83

Platform Loads

Use		*Uniform load per square foot*
Stone masons		75 pounds stone on scaffold
Stone setters, bricklayers	Heavy duty	40 pounds, no stone on scaffold; 50 pounds, stocked
Carpenters, miscellaneous; painters and decorators	Light duty	25 pounds
Stucco workers		30 pounds, hod stocked
Lathers and plasterers		30 pounds
Lathers, precast work		weight of bay, casts, and men

NOTE.–If concentrated load is used at any point in the span, it should not exceed one-half the allowable distributed load.

(2) Safety Factor. Scaffolds shall be capable of supporting the working load, with a safety factor of at least four. For guidance refer to *Design Specifications for Stress Grade Lumber* published by the National Lumber Manufacturers Association, Washington, D. C.

(3) Distribution of Load. Whenever possible, scaffold load should be uniformly distributed and not concentrated at the center of the platform.

(4) Overloading. Scaffolds must never be overloaded.

d. Specification for Lumber

(1) Thickness. Planking shall be of uniform thickness and laid close together. Planks may be lap- or butt-jointed.

(2) Width. Scaffold platforms shall be not less than 20 inches wide except as otherwise required by specifications herein.

(3) Kinds. Lumber used in the construction of scaffolds shall be either spruce, Douglas fir, southern (long-leaf) yellow pine, or wood of equal strength. Hemlock, short-leaf yellow pine, or other short fiber lumber shall not be used.

(4) Condition. Lumber shall be dressed (except scaffold plank may be rough), of good quality, reasonably straight grained, free from large and medium shakes, checks, splits, and unsound knots. The lumber shall be free also from dry rot and growth characteristics which impair its strength.

(5) Sizes. Lumber sizes used in these requirements refer to nominal sizes.

(6) Protection. When not in use, scaffold planks should be carefully stored and protected from the weather.

(7) Testing for Safe Load. Scaffold planking may be sample tested by center loading with an applied load equal to four times the working load. Any sample plank selected out of a lot shall be discarded even though it withstands the load, if it sustains any partial failure or remains deformed after such test loading. Other methods of testing scaffold plank may be used if recommended by the United States Forest Products Laboratory.

(8) Marking Safe Load. The maximum safe load and the date tested should be plainly indicated on the planking by stamping or other method. Safe loads are indicated in the table on the following page.

e. Ropes, Lines, and Cables

(1) Quality. Ropes and cables used in suspension and swinging scaffolds shall be of the best quality steel, manila, or sisal in accordance with the applicable Federal or Military specifications.

(2) Safety Factor. All ropes supporting scaffolds shall be manila or sisal rope and shall have a safety factor of at least six, and shall be inspected before being used on each job to ascertain whether they are sound and free from flaws or deterioration from weathering and from contact with any corrosive chemicals.

(3) Hook Attachment. Where ropes supporting scaffolds are not attached directly to hooks, the extension from the top block to the support shall be at least a one-half inch wire rope.

1739

MT-PWHD-005346

REDACTED
J-M 83

Safe Center Loads for Platform Plank (in Pounds)
(1,100 lbs. fiber stress[1])

Span in feet	2 x 10 dressed to 1-5/8 x 9-1/2	2 x 12 dressed to 1-5/8 x 11-1/2	3 x 8 dressed to 2-5/8 x 7-1/2	3 x 10 dressed to 2-5/8 x 9-1/2	3 x 12 dressed to 2-5/8 x 11-1/2
6	256	309	526	667	807
8	192	232	395	500	605
10	153	186	316	400	484
12	128	155	263	333	404
14	110	133	225	286	346
16	...	116	197	250	303

[1]Values are for one plank supported at the ends, wide side of plank face up, and with loads concentrated at the center of the span. For loads uniformly distributed on the wide surface throughout the length, the safe loads may be twice those given in the table. Loads given are net and do not include weight of the plank.

(4) Lifelines and Safety Belts. Lifelines and safety belts shall be used when working on a boatswain's chair, and on unguarded scaffolds at heights of 10 feet and above. Manila or sisal rope used as lifelines shall be 5/8 inch in diameter. See Figure 8 for illustration of use of lifeline for moving scaffold platforms.

(5) Cleaning Buildings. When cleaning buildings with solutions containing chemicals injurious to hemp rope fibers, wire ropes shall be used wherever possible for swinging scaffold supports.

(6) Safety Belts. Where required workmen shall wear Navy approved safety belts which have been securely attached to a safety line by a mechanical safety device.

(7) Damaged Rope. Rope which has been in contact with acid shall be immediately removed and destroyed.

(8) Fall Line. The fall line shall be kept on the outside of the scaffold, with the free end in a box or barrel, located so that the rope will slope away from the building or structure.

(9) Open Flame. Burning or welding, blow-torch operations, or the presence of any open flame shall not be permitted on a scaffold supported by a fiber suspension rope or sling. Should such operation be necessary, the sling or suspension shall be of wire cable.

f. Scaffold Nails

(1) Importance. The safety of a structure depends upon the nails as well as upon the timbers selected. The safety of a nail connection depends upon the resistance of the timber and not upon the material of the nail.

(2) Nail Requirements

(a) Minimum size. Nails smaller than 8d common shall not be used. Nails shall be driven full length.

(b) Lateral resistance. The quantity and size of nails used shall be determined by values in pounds for each size (as shown in the following table) and for materials being used as applied to the total load to be supported.

(c) Parallel pull. Nails will not be used so that the pull is parallel to the length of the nail.

(d) Special designs. Where special scaffold designs are required the quantity and size of nails to be used shall be in accordance with *Design Specifications for Stress Grade Lumber* published by the National Lumber Manufacturers Association, Washington, D. C.

1740

MT-PWHD-005347

REDACTED
J-M 83

0008 1030

Lateral Resistance in Pounds per Nail in Rocky Mountain Douglas Fir[1]

Size of nail	8d	10d	12d	16d	20d
Perpendicular[2]	65	80	80	90	115
Parallel[3]	45	55	55	60	80

[1]Values for other woods such as coastal region Douglas Fir and Southern pine may be 20 to 25 percent greater.
[2]Nails driven perpendicular to grain.
[3]Nails driven parallel to grain.

(3) Spacing. Nails should not be driven closer than one-half of their length from the end of the board nor nearer than one-quarter of their length from the edge of a board.

2. **All-Pole Scaffolds**

a. **Foundations**

(1) Poles Plumb. All poles or posts shall be set up plumb.

(2) Footings. Scaffold poles shall not stand directly on the ground but shall bear on a footing of sufficient area and strength to spread the load in order to prevent settlement. When the footing is of wood it should be a solid block not less than 1 foot square by 2 inches thick. The footing block shall be placed on solid ground and sufficiently below the surface to prevent displacement. The base of the pole shall be set and securely held in the center of the block.

(3) Bracing. When a pole is set directly on a solid object such as a sidewalk, it shall be blocked or braced against movement.

b. **Splicing Poles or Posts**

(1) Ends Squared. When poles are spliced, the squared end of the upper section shall rest upon the squared end of the lower section, and the two ends shall be rigidly fastened together with no less than two wooden splice plates.

(2) Splice Plates. Splice plates should be at least 4 feet long and of the same width as the uprights. The plates shall be securely nailed in place on adjoining sides of the poles. The combined cross-sectional area of the splice plates shall be not less than that of the pole, and the plates should be placed so that they overlap the abutting ends of the pole equally. They shall be located so as not to interfere with the nailing of ledgers or putlogs.

(3) Overlapping Ends. In light-duty scaffolds not more than 24 feet in height, uprights may be spliced by overlapping the ends not less than 4 feet and securely nailing them together. A substantial cleat shall be nailed to the lower section to form a support for the upper section.

(4) Staggering Splice. Splicing shall be staggered. Adjacent uprights, either transverse or longitudinal, shall not be spliced at the same level.

c. **Bumpers as Protection.** As a protection against the impact of vehicles and personnel, the bases of uprights shall be protected from displacement by bumpers set independent of the scaffold.

d. **Planking on Putlogs and Bearers**

(1) Lapping Ends. Each platform plank shall be of sufficient length to extend over three putlogs. Ends shall be lapped over the putlog.

(2) Planks Overlapping. When planks overlap, a single putlog is sufficient. The ends of both the upper and lower planks should overlap the putlog by at least 6 inches.

(3) Planks End to End. When planks are laid end to end, two parallel putlogs shall be provided not more than 8 inches apart so that one putlog will support the end of one plank and the other putlog the end of the other plank. Two successive lengths of planking shall not abut beyond a single putlog.

(4) Projection over Putlog. Planking shall project over the last putlog at the end of the scaffold by at least 6 inches, but in no case more than one foot.

(5) Turning Corner. When a scaffold turns a corner, the planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, and extend over the diagonally braced putlog

1741

MT-PWHD-005348

0008 1031
REDACTED
J-M 83

far enough to have a good safe bearing, but not far enough to involve any danger from tipping; then the planking running in the opposite direction, at right angles, shall be laid so as to extend over and rest on the first layer of planking.

e. Ledgers

(1) Shifting Platform. When a platform is shifted or raised, the new ledger boards shall first be nailed to the uprights at the proper height; then the putlogs that are to support the new platform shall be set.

(2) Placed against Inside Face of Pole. Ledgers shall be securely nailed or bolted to each upright and, except where they interfere with the bracing, shall be placed against the inside face of the pole.

(3) Nailed Level. All ledgers shall be nailed up level. In the case of single-pole scaffolds, the top edges of the ledger shall be at the same height as the bottom of the openings in the wall which receives the inner end of the bearers, so that both bearings will be at the same level.

(4) Leave old Ledger in Place. As the platform is raised with the progress of the work, the ledgers upon which it previously rested shall be left in place to brace and stiffen the upright until the scaffold is dismantled.

(5) Old Platform. The old platform shall be left undisturbed until the new putlog has been set in place. Also, until the working platform is entirely planked over, it is advisable to leave a platform two or three tiers below the working platform, to lessen the severity of injury should men fall, and as a protection to persons below from falling materials.

(6) Overlap. Ledgers shall be long enough to extend over two upright pieces and should overlap the poles by at least 4 inches. Where two ledgers overlap on the same upright, each shall be securely fastened; one first being nailed to and through the inner one. Nails should be kept distributed.

(7) Splicing. In heavy-duty scaffolds, the combined cross-sectional area of the splice plates shall not be less than the cross-sectional area of the ledger. The splice plates shall be so placed as to overlap the abutting ends of the pole equally and shall be so located as not to interfere with the nailing of ledgers. Ledgers shall always be spliced at poles.

(8) Ledgers at Right Angle. When two ledgers meet at right angles on a pole, one shall be fastened on the inside and its end cut off flush with the face of the pole, and the other fastened on the outside and overlapping the inside one.

(9) Reinforcing Ledgers. Ledgers supporting heavily loaded platforms shall be reinforced by bearing plugs, braces, or cleats securely nailed to the side of the pole, forming a support for the ledger.

f. Bearers or Putlogs

(1) Greater Dimension Vertical. Bearers and putlogs shall be set with their greater dimension vertical, and shall be long enough to project at least 3 inches over the ledger beyond the outer row of poles, and the same distance beyond the inner row (of independent pole scaffolds).

(2) Support. Bearers shall be supported on the ledger located against the sides of the pole and nailed to both the pole and ledger. Where intermediate bearers are used for the support of planking, the ledger shall be reinforced as necessary.

g. Bracing of Scaffolds

(1) Diagonal Bracing. Diagonal bracing shall be provided to prevent the poles from moving in a direction parallel with the building, or from buckling.

(2) Between Inner and Outer Uprights. Cross bracing shall be provided between the inner and outer sets of poles in independent-pole scaffolds.

(3) Free End Bracing. The upper free ends of pole scaffolds shall be cross-braced.

(4) Away from Building. Braces which are used for the purpose of holding the scaffold at a fixed distance from the building shall be secured to the pole.

(5) High Scaffolds. Scaffolds which extend to a height of more than 40 feet and support heavy loads of material shall be thoroughly and substantially braced.

1742

MT-PWHD-005349

0008 1032 REDACTED J-M 83

h. Guard Rails

(1) Open Side. A standard guardrail and toeboard shall be provided on the open side of the platform on all single-pole and independent-pole scaffolds.

(2) Building Side. If the space between the scaffold and building is more than 18 inches, a standard guardrail shall be erected on the building side.

i. Specifications for Members. Nominal dimensions of lumber and spacing of scaffold members are given in the following tables. (See article 0836.1c and e for standards for planking, loading, and nailing, and Figures 1-3 for illustrations.)

3. Single-Pole Scaffolds (See Figure 3)

a. Ledgers as Braces. Ledgers shall be left in place to brace the scaffold after platform planks are removed.

b. Putlogs. In a single-pole scaffold the inner end of the putlog shall rest in the wall of the building with at least a 4-inch bearing. The putlog shall not be notched out or cut down, except in alteration or light repair work, when it may be notched or cut

Minimum Dimensions of Lumber for Pole Scaffolds[1]
(Load in pounds per square foot)

Member	25 lb. load	Over 25 lb. and not over 75 lb.[2] load	
	Single and independent pole (inches)	Single pole (inches)	Independent pole (inches)
Poles:			
24 ft. or less	2 x 4	3 x 4 or 2 x 6	3 x 4 or 2 x 6
Over 24 ft., not over 40 ft.	3 x 4 or 2 x 6	4 x 4	([3])
Over 40 ft	([2])	([2])	([2])
Stringers:			
24 ft. or less	1 x 6	1 x 6	1 x 6
Over 24 ft., not over 40 ft.	1 x 6	1 x 6	2 x 8
Putlogs or bearers	4 x 6 or 2 x 6 on edge.	4 x 4 or 2 x 8 on edge.	2 x 8 on edge.
Ledgers	2 x 6	2 x 8	2 x 8
Braces	1 x 4	1 x 6	1 x 6
Planking	2 x 10	2 x 10	2 x 10
Toeboards	1 x 6	2 x 6	2 x 6
Guardrails	2 x 4	2 x 4	2 x 6

[1]See loading standards, article 0836.1d(8).

[2]Pole scaffolds carrying more than 75 pounds per square foot load and greater than 40 feet in height shall be designed by a qualified engineer in accordance with "Design Specifications for Stress Grade Lumber," of the National Lumber Manufacturers' Association (latest revision), Washington, D. C.

[3]Over 25 lb. and not over 50 lb. shall be 4" x 4"; over 50 lb. and not over 75 lb. shall be 4" x 6".

1743

MT-PWHD-005350

0008 1033
REDACTED
J-M 83

Spacing of Scaffold Members

Member	25 lb. per sq. ft. load or less	Over 25 lb. but not over 75 lb. per sq. ft. load
All pole maximum spacing (longitudinal).....	7 ft. 6 in.	7 ft.
Independent pole minimum spacing (transverse):		
24 ft. or less.....	6 ft. 6 in.	6 ft. 6 in.
Over 24 ft., not over 40 ft.....	7 ft. 6 in.	10 ft.
Ledger maximum spacing (vertical).....	7 ft.	4 ft. 6 in.
Single pole spacing from wall.....	3 to 5 ft.	3 to 5 ft.

down to fit into a space made by the removal of a brick. In such cases, the notch shall be made on the upper side of the putlog and only deep enough to permit its being inserted in the hole in the wall.

c. Spring Staybraces. When putlogs are removed in single-pole scaffolds, spring staybraces shall be inserted to take their place, and shall be located in at least every alternate upright of every row of putlogs. When a brick is inserted for holding the two boards of a spring stay apart, it should be kept near the wall to ensure a good grip of the brace in the hole of the brick work.

d. Attached to Frame Building. When the inner end of a putlog is attached to a frame building, a piece of lumber not less than 2 x 6 x 12 inches, shall be notched out the width of the putlog and not less than 2 inches deep, and nailed to the side of the building to form a bearing.

e. Securing Putlog. The end of the putlog shall rest on the bearing and shall be nailed to both the bearing and the building.

f. Window Sill Support. When the inner end of a putlog goes through a window opening, it shall be supported on a thick plank or other support resting on the window sill. The support shall be securely braced against displacement.

4. Independent Pole or Built-Up Scaffolds

a. Specifications. See article 0836.2i for dimensions and spacing of members and Figures 1 and 2 for illustrations.

b. Placing Inner Poles. The inner row of poles shall be set as near to the building as practicable and still allow workmen ample working space.

c. Bracing Poles

(1) The outer row of poles should be connected by diagonal braces at an angle of about 45°.

(2) The bracing shall be securely fastened to the pole by a sufficient number of nails.

(3) Diagonal braces should run up across the entire face of the scaffold in both directions. Braces should be spliced at the poles.

(4) In very high or heavy duty scaffolds, the inner row of poles should also be braced in the manner described in the preceding paragraph.

5. Barge (Pontoon) Scaffolds

a. Purpose. Scaffolds shall be constructed to ensure adequate rigidity under sudden surges, such as those caused by water swells.

b. Weather Restrictions. Personnel shall not be permitted on a barge scaffold in rough weather.

c. Dock Trial Restrictions. During dock trial of a ship, barge scaffold work shall not be permitted.

d. Safety Belts. Safety belts, secured to scaffold, shall be worn by personnel if "rocking" of scaffold is severe enough to make it difficult to maintain proper balance at all times.

1744

MT-PWHD-005351

0008 1034

REDACTED
J-M 83

e. "Camels." When working between two ships or between ship and dock, "camels" shall be provided to prevent crushing of barge through movement of the vessels.

f. Ships' Engines Secured. Before men are permitted to perform work from a scaffold at or near the stern of a ship, definite assurance must be obtained by the hull superintendent from the officer of the deck that the ship's engines have been secured. When possible, barge shall be kept clear of propellers.

g. Wood Constructed. When barge scaffolds are constructed of wood, the following table shall govern:

Poles	4 in. x 6 in.
Putlogs	3 in. x 6 in.
Splices	2 in. x 6 in.
Braces	1 in. x 8 in.
Pole spacing (longitudinal)	7 ft. to 10 ft.
Pole spacing (transverse-bottom)	12 ft.
Pole spacing (transverse-top)	8 ft. to 10 ft.
Planking	2 in. x 10 in.
Height between platforms	8 ft.

h. Tubular Pole. Tubular pole scaffolds shall be erected in accordance with "Tubular Pole Scaffolds" requirements in article 0836.6.

i. Proportional Dimensions

(1) Width. In no case shall the over-all width of the erected poles be more than 80 percent of the width of the barge upon which it is erected.

(2) Length. The distance between end poles shall not exceed 80 percent of the barge length.

(3) Height. The height of the working platform shall not be greater than the over-all distance between the end poles.

(4) Weight. Weight of scaffold shall not constitute more than 50 percent of the total displacement of the barge scaffold system.

(5) List. The maximum working load concentrated at the greatest point of leverage shall not cause the barge scaffold to list more than 3°. Ballast may be employed to correct this list.

j. Center of Gravity

(1) Keep Low. The combined center of gravity of the barge and scaffold shall be kept as low as possible.

(2) Line of Buoyancy. The combined center of gravity of the barge and erected scaffold shall be in the same vertical line with the center of buoyance when the barge with scaffold is floating in still water. If necessary, ballast permanently secured to barge may be used to effect this condition.

(3) Metacentric Height. The height of the scaffold and the length of the cantilever putlogs beyond the inboard poles shall be limited to those distances which will ensure a metacentric height sufficient for adequate initial stability or "righting arm".

k. Attaching Scaffold to Barge

(1) Angle Clips. All poles shall be firmly secured to the deck of the barge by means of two 6-inch by 6-inch angle clips.

(2) Centered. Poles shall be centered on the barge in all directions.

(3) Bolts. Clips shall be welded or bolted, as appropriate, to the deck, and so spaced that the backs fit snugly against the 6-inch side of the uprights. They shall be bolted in this position, from one to the other through the uprights, by not less than three nor more than four 1/2-inch galvanized steel bolts. Bolts shall be equipped with lock washers.

l. Requirements for Barges

(1) Free Board. Barges upon which a scaffold is erected shall have a minimum of 1 foot of free board.

(2) Design. Barges shall be of an approved design and shall be thoroughly seaworthy in every detail.

(3) Deck Fittings. Barges shall be equipped with such deck fittings as will permit proper maneuvering and mooring.

(4) Hatch Covers. Hatch covers shall be equipped with rubber gaskets and dogs. Covers shall be firmly battened down except when opened for entering or leaving a hull.

(5) Fenders. Barges shall be equipped with fenders.

MT-PWHD-005352

0008 1035
REDACTED
J-M 83

(6) Hull. Barge hull shall be maintained in a watertight condition.

(7) Alongside Ship. When in position alongside of ship the barge shall be secured to ship.

(8) Platforms. Standard guardrails and toeboards shall be provided along the sides of the platform not used for performing work.

(9) Width of Gap. The gap between the working platform's edge and the ship's hull shall not exceed 1 foot.

(10) Life Ring. At least one life ring shall be provided on a barge.

6. Bricklayer's Square Scaffolds (See Figure 6)

a. Dimensions

(1) Tiers. When this type of scaffold is used, it shall be built up not more than three tiers or squares high. The tiers shall be braced together both front and rear, to give stability and rigidity.

(2) Details. The squares shall be of clear material not larger than 5 feet on each side and shall be framed as shown in Figure 6. The main members shall be 2 by 4 with top and bottom members overlapping the uprights. The corner braces shall be 1 by 6 and the main diagonal braces shall be 1 by 8.

b. Bracing

(1) Cross Bracing. Cross bracing shall be placed laterally from the bottom of each square to the top of the adjacent squares. Such bracing shall be 1 by 6 material.

(2) Side Bracing. The squares shall have 1 by 6 lateral side braces on both sides running from the center of each member to the center of the adjacent member.

c. Spacing Squares

(1) Distance Between. The squares shall be spaced not more than 5 feet apart on heavy-duty scaffolds and not more than 8 feet apart on light-duty scaffolds.

(2) Superimposed. When erected in squares the squares shall be placed one directly above the other.

d. Support of Scaffolds. The scaffolds shall be set up on a level and unyielding foundation.

e. Planking

(1) The upper tier shall stand on continuous rows of planks laid across the lower tier.

(2) Planks shall be nailed or cleated.

(3) Each plank should extend over three squares.

(4) The ends of planks shall overlap the squares by at least 4 inches and not more than 6 inches.

7. Tubular Pole Scaffolds

a. Personnel. Only experienced or properly trained personnel shall erect, dismantle, or rearrange tubular pole scaffolding.

b. Material Used. The scaffold members shall be of galvanized steel tubing or other corrosion resistant metal of equal strength.

c. Locking Device. All vertical and horizontal members of a scaffold shall be fastened together with a coupler or approved locking device forming a positive connection to prevent movement of the scaffold when in use. The locking device shall be of a type having no loose parts.

d. Material Used in Locking Device. The locking device or coupler shall be of drop-forged steel, galvanized, or material of equal strength and corrosion resistance. Use of gray cast iron fittings is prohibited.

e. Dimensions of Members. In the construction of tubular pole scaffolds members of the dimensions listed in the table on page 8-39 should be used.

f. Safety Factors. Scaffolds shall be designed to have a factor of safety of not less than four.

g. Putlogs

(1) Attaching. Tubular putlogs shall be placed at right angles to the runners and attached thereto with couplers.

(2) Location. Putlogs shall be located at each set of uprights and at each level including intermediate levels where working platforms are installed.

(3) Overhang. Putlogs shall overhang at least 10 inches beyond the inside and outside uprights.

1746

MT-PWHD-005353

REDACTED
J-M 83

Member	Light-duty	Medium-duty	Heavy-duty
Pole	2 in. O.D.	2 in. O.D.	2 in. O.D.
Putlog	2 in.	2-1/2 in.	2-1/2 in.
Runner	2 in.	2 in.	2 in.
Bracing	2 in.	2 in.	2 in.
Pole Spacing			
Longitudinal	10 ft.	8 ft.	6 ft. 6 in.
Transverse	6 ft.	6 ft.	6 ft.

NOTE.–For scaffolds up to 75 feet in height, poles of 2-inch O.D. tubing, as per table, should be used. For heights 75 feet to 200 feet, 2-1/2-inch O.D. tubing shall be used.

(4) Pitch. The putlogs should have a slight downward pitch towards the building wall.

(5) Clincher Plate. In the case of single-pole tubular scaffolds, the putlogs should be equipped on the inner end with a 3/16-inch steel clincher plate which hooks into the vertical brick joint.

h. Runners

(1) Locking. The tubing forming the runners shall be locked end to end with fittings and secured to each intersecting upright with couplers.

(2) Leveling. The bottom runner shall be leveled both lengthwise and crosswise.

(3) Proper Height. When attaching the upper runner, the couplers should first be located at the proper height on the upright by means of a measuring stick.

i. Bracing. Tubular bracing shall be applied both lengthwise and crosswise, as required.

(1) Lengthwise. Lengthwise bracing shall be located on the outer face of the scaffold and secured to the projecting ends of the putlog with couplers, or in some other approved manner.

(2) Crosswise. Crosswise bracing shall be located on every fourth or fifth set of poles and attached with couplers to the runners at alternate levels.

(3) Keeping Scaffold Plumb. The scaffold shall be kept plumb and rigid by means of adequate bracing.

j. Poles

(1) Keep Plumb. Poles shall be kept plumb during erection.

(2) Firm Foundation. Poles shall be fitted with bases supported on a firm foundation or on sills to distribute the load. When wooden sills are used, the bases shall be fastened thereto.

(3) Adjustable Couplers. At the foot of poles where there are no horizontal runners or putlogs to attach to, adjustable couplers shall be used for attaching the bracing to the poles.

8. Rolling Scaffolds

a. Structural Requirements. Construction of rolling scaffolds shall conform to the requirements for tubular pole scaffolds. They shall be constructed either in accordance with manufacturer's recommendations or in accordance with special designs by Navy engineers. The feet of such scaffolds shall be equipped with wheels or casters, especially made for this purpose, which are capable of being positively clamped or locked to prevent rolling.

b. Responsibility for Movement. The senior military or civilian supervisor present shall be responsible for safe movement of rolling scaffolds. Such scaffolds shall not be moved except at his command. He shall take particular care that the scaffold does not foul overhead electric or telephone lines, roof members, or suspended fixtures. NO PERSON SHALL REMAIN ON THE SCAFFOLD WHILE IT IS BEING MOVED.

9. Suspended Scaffolds

a. When Used. The use of a suspended scaffold is recommended for all buildings more than five stories high to which outriggers can be adequately fastened.

1747

MT-PWHD-005354

0008 1037 REDACTED J-M 83

The parts of the building or structure to which a suspended scaffold is attached shall be examined to determine if such parts are of sufficient strength to support properly and safely the load that will be applied to the scaffold.

b. Approved Type. Scaffold hoisting machines shall be of a design approved by the Underwriters' Laboratories.

c. Never Used for Heavy Material. Suspended scaffolds shall never be used for the storage of stone or heavy materials.

d. Workload. Suspended scaffolds shall be capable of sustaining a working load of 40 pounds per square foot.

e. Webs Vertical. All beams and channels shall be set with their webs vertical.

f. Hoisting Machine. Suspended scaffolds shall be provided with a hoisting machine of either the platform or overhead type.

g. Experienced Men. Experienced men only shall be permitted to operate the machine.

h. Outriggers

(1) Anchoring. The outriggers should consist of steel I-beams, each securely anchored to the framework of the building by U-bolts and anchor plates or other equally safe means.

(2) Channel Irons. If channel irons are used instead of I-beams, they shall be in pairs, placed back to back and fastened together with bolts or clamps. Where greater bearing width is required, pipe separators may be used.

(3) Strength. The outriggers shall be equivalent in strength to standard 7-inch 15.3-pound I-beams and shall be at least 15 feet long.

(4) Projection. The outriggers shall project at least 1 foot beyond the outer edge of the suspended platform.

(5) Stop-Bolt at End. A stop-bolt shall be placed at the outer end of every outrigger.

(6) Securing. When the inner end of the outrigger extends inside the building, it shall be secured to the building structure.

(7) Placing Shackles. The shackle supporting the outside cable shall be placed not more than 6 feet beyond the bearing point of the outrigger on a 4-foot scaffold; and the shackle supporting the inner cable shall be placed not more than 2 feet beyond the bearing point of the outrigger. When the platform is wider than 4 feet, the inner and outer suspension cables shall be so located as to hang vertically.

(8) Raising Outrigger. When it is necessary to raise the outrigger above the supporting beam, it shall be blocked up on the supporting beam with steel or hardwood blocking.

(9) Support for Platform. When platforms wider than 4 feet are required, the strength of the outriggers shall be increased accordingly.

i. Bearers

(1) Dimensions. The platform bearers shall be of steel, not less than a pair of 2 by 2-3/16-inch standard angles, or other sections of equivalent strength. If wooden bearers are used, they shall be of long leaf yellow pine, not less than 4 by 6 inches. Wood of equivalent strength can be used, with the greater dimension vertical.

(2) Support for Hoisting Machine. The supporting frame of the hoisting machine shall be bolted to the bearers at the outer and inner ends with bolts not less than 5/8 inch in diameter.

(3) Length. The bearers shall be of sufficient length to receive at least six 8-inch planks with the inner and outer row of planks passing through the supporting frame of the hoisting machine.

(4) Planks. The platform planks shall be laid close together and overlap the bearers at each end of the scaffold by not more than 18 inches.

(5) Connections. When conditions arise where the use of the standard U-bolt connection is not practicable, the beam clamp connection should be used.

j. Cables

(1) Connection. The lower end of the supporting cable shall be secured to the hoisting machine by passing the end of the cable through a hole in the drum and securely fastening it by a clip; or by passing it through

1748

MT-PWHD-005355

0008 1038

REDACTED
J-M 83

a hole in the web of the rachet wheel, and making a socketed connection.

(2) Prevention of Swinging. Strap-iron hooks shall be wired to the suspension ropes near the platform level and hooked onto the building to prevent the scaffold swinging away from the building. Fenders shall be used, consisting of pieces of plank nailed to the platform and projecting inward towards the building.

(3) Terminals. The upper ends of the cables shall terminate in a spliced loop in which a steel ring or eye is inserted. The bolt passing through the shackle and ring shall be drawn up tight by a nut and lock-nut.

(4) Secured to Outriggers. The suspension cables when fixed at their upper ends shall be secured to the outriggers by wrought-iron shackles and bolts.

(5) Steel Rope. Steel wire ropes should be used for the support of suspended platforms in preference to steel ribbons or chains. Such ropes shall have a breaking strength of not less than 5 tons.

(6) Hanging Vertical. As a guide in determining the width of the platform, the suspension cables should hang as nearly vertical as possible.

k. Safety Belts. Every man going out on an outrigger shall be provided with and shall wear a safety belt to which shall be attached a lifeline securely fastened to the building. The lifeline shall be only of sufficient length to permit the work on the outrigger to be performed, and so that in the event of a fall, the fall will be broken as quickly as possible.

l. Inspection of Bolts. Frequent inspection shall be made to see that the threads on all bolts are perfect, that the nuts fit, and that the cable clamps are securely fastened to the outriggers.

m. General Inspection. All parts of a suspended scaffold shall be inspected daily.

n. Side Screen. The space between the toe board and the guardrail shall be filled with 16-gage, 1-1/2-inch mesh wire netting.

o. Working Parts Exposed. All working parts of scaffold hoisting machines shall be left exposed so that defective parts or irregular working of the machine can be easily detected.

10. **Suspended Stage Platforms.** Suspended stage platforms shall not be rigged to a marine derrick or other weight-lifting device when it is practicable to use other types of staging.

a. Not Rigged to Derrick. A suspended-stage platform shall not be rigged to a marine derrick or other weight-lifting device when wave action will disturb the steadiness of the platform.

b. Members of Steel. The foundation members of a suspended stage platform shall be of structural steel. Channels, angles, T, H, or I-beams may be used.

c. Member at Center of Gravity. In the construction of the platform frame, in addition to the members placed at each end, a member shall also be placed on the center of gravity of the platform. (Center of gravity is that for the designed platform without load and counterweight.)

d. Wire Rope. Approved wire rope connections shall be used.

e. Safety Factors and Tests. The frame shall be capable of supporting a load equal to four times the maximum working load. When testing, the load should be applied at the diagonal corners with the frame balanced over a fulcrum.

f. Sling Legs. Sling legs shall support platform at each corner at the counterweight end and at a point on each side of frame as near as is practicable to the end of the platform used by the employees.

g. Testing Crane and Boom. Before platform is actually used, a test shall be conducted to determine the stability of the crane or derrick and the safe working radius of the boom with the working load on the platform.

h. Boom Radius. Under actual use, the boom radius shall not be increased beyond that found to be safe.

i. Qualified Operator. The hoisting, lowering, and lateral movement of suspended platforms shall be under the direction of qualified riggers. They shall give all signals to crane or derrick operators.

1749

MT-PWHD-005356

REDACTED
I-M 83

j. Determining Overturning Moment. In the design of a suspended-stage platform, the overturning moment shall be determined on the basis of the maximum number of employees at work on the platform at any one time, concentrated at one end. This concentrated weight, times its distance from the fulcrum legs of the sling, shall be not more than one-fourth of the weight of the counterweight times its distance from the fulcrum.

k. Wire Rope Slings

(1) Safety Factor. Suspended-stage platforms and wire rope slings shall be designed so that the strength is equal to the working load with a safety factor of four.

(2) Attaching Slings to Platform. Approved methods shall be used for attaching wire rope slings to platform frame.

(3) Specifications. Wire rope slings shall be of 6 by 19 improved plow steel and shall not be less than 3/4 inch diameter.

(4) Limited Use. Wire rope slings used for supporting a platform shall not be used for any other purpose.

(5) Platform Suspended. The platform shall be suspended from a four-legged wire rope sling.

l. Planks Bolted to Frame. Platform planks shall be bolted to the frame. Bolt heads shall be counter-sunk.

m. Guardrails. Suspended-stage platforms shall be equipped with either pipe or angle-iron standard guardrails and toe boards along such portions of each side and end not actually used for performing the work.

n. Hooks Moused. Hooks used for suspended-stage platforms shall be adequately moused.

o. Guidelines. Tag or guidelines, used for steadying or keeping suspended platforms in position, shall be attended by an experienced tradesman.

p. Use of Platforms as Elevators. Platforms shall not be used for the elevation of employees, materials, or equipment other than that determined to be needed for the immediate job.

q. Counterweights. A counterweight shall be of iron or concrete. It should be placed and secured at a point at least 12 inches from the end of the platform, opposite the end which will be used by the employees.

r. Life Rings. At least two life rings shall be attached to platforms suspended over water.

s. Boarding Platforms. Employees shall board and leave platforms at designated places.

t. Jumping on Platforms. Jumping on or off platforms is forbidden.

11. Boatswain's Chair (See Figure 7).

a. Dimensions of Chair. The chair shall be a seat not less than 2 feet long and 1 foot wide by 1-1/4 inches thick.

b. Cleats. Where practicable, cleats should be screwed to the underside of each end of the chair and project at least 9 inches in front of the seat.

c. Suspension Rope. The chair shall be supported by means of a sling attached to a suspension rope. This rope shall either be securely fastened to a fixed object overhead or pass through a securely fastened overhead block. The free end shall be fastened to a fixed and easily accessible object.

d. Strength of Sling. The sling shall be of at least 5/8-inch diameter manila rope, or its equivalent in strength.

e. Stirrups. When the suspension rope is attached to a pole by means of a hitch, the workman shall be provided with stirrups supported independent of the chair, upon which he can rest his weight while he is shifting the pole hitch.

f. Safety Belt.

(1) Lifeline. Every workman using a chair shall be provided with a safety belt. The safety belt shall be attached to a hanging lifeline secured to a fixed object.

(2) Tail Line. Where a tail line on the safety belt is used to connect to the hanging lifeline, a rolling hitch should be used to make such connection.

g. Open Flame. Burning and welding, blow-torch operations, or the presence of any open flame shall not be permitted on or near a chair unless suspension ropes and sling are of steel. In such cases, the sling shall be of at least 3/8-inch diameter wire rope.

MT-PWHD-005357

0008 1040
REDACTED
J-M 83

12. **Float (Ship) Scaffolds**

a. Purpose. Scaffolds of this type shall be used only for the support of men doing riveting or other light work.

b. Open Flame Nearby. Burning and welding, the use of a blowtorch, or the presence of any open flame shall not be permitted on or nearby float scaffolds unless suspension ropes are of steel. The use of fiber rope under these conditions is prohibited.

c. Number of Men. A maximum of two men shall be permitted to work on a scaffold.

d. Dimensions

(1) The plank bearers shall be not less than 2 inches by 8 inches and should project not less than 6 inches beyond the platform on both sides. A diagonal plank, not less than 1 inch by 6 inches, shall extend from bearer to bearer underneath the platform. Each platform plank shall be nailed to this diagonal board and to the two parallel plank bearers.

(2) The holes in the bearer planks, as specified above, should be approximately 2 inches outside the outer planks.

(3) Platforms shall not be more than 5 feet wide and 8 feet long.

(4) Ends of platform planks shall extend at least 6 inches but not more than 12 inches beyond the outer edges of the bearers.

e. Rope Size. Rope shall be not smaller than 7/8 inch in diameter.

f. Support of Platform. The platform shall be supported by a continuous rope at each end. The ends of each rope shall be securely fastened to an adequate overhead support.

g. To Prevent Slipping. The platform shall be so secured to the rope that slipping is impossible. A bowline knot should be used. Rope should pass downward through a 1-inch hole in the bearer plank, be angle-hitched around the bearer plank and pass along beneath it to the other end, where it should be angle-hitched and passed upward through the 1-inch hole to the overhead support.

13. **Interior-Hung Scaffolds**

a. Substantial Beams. Where an interior-hung scaffold is required for ceiling work, it shall be hung or suspended from substantial beams of the roof structure.

b. Dimension of Materials. For interior-hung scaffolds, the following minimum nominal size material shall be used:

Bearers	2 x 10 in. (12 ft. on center)
Joists	3 x 4 in. (24 ft. on center)
Wire Cable	1/2 in. diameter
Spacing of cables	10 ft. to 12 ft.

c. Work Load. Irrespective of the above schedule, all interior-hung scaffolds shall be designed to sustain a uniformly distributed workload of at least 15 pounds per square foot. When used for plastering, this scaffold shall be designed to sustain a distributed working load of at least 25 pounds per square foot. A factor of safety of four shall be applied in both cases.

d. Cables Securely Fastened. The interior-hung scaffold shall be supported by means of wire cables, which shall be wrapped twice around the supporting member and twice around the bearer of the scaffold.

e. Cable Slips. Each end of the cables shall be secured by at least three standard cable clips.

14. **Masons' Swinging Scaffolds**

a. Design of Scaffold. Swinging scaffolds intended for masons' use in setting stone or cleaning down walls, shall be similar in design to other swinging scaffolds, but shall have a platform at least 30 inches wide suspended from overhead steel beam outriggers with steel wire cables and operated by a scaffold machine.

b. Use of Two Scaffolds. When two or more such scaffolds are in use on a building, they shall not be bridged across one to the other or lashed together.

c. Platform Construction. The platform shall be not more than 20 feet in length and constructed with 4-inch channel at each end. Channel shall be laid flat with flanges down and slotted to receive the machine hangers.

MT-PWHD-005358

0008 1041

REDACTED
J-M 83

d. Stringers. The two side stringers should be bolted to the channels.

e. Tie Rod. There shall be a 5/16-inch diameter tie rod located 7 feet from each end of the platform, passing through the side stringers and drawn up tight with washers, nuts, and lock nuts.

f. Guardrail. A standard guardrail shall be secured to angle iron uprights, bolted to the stringers.

g. Uprights. The uprights shall be located at each end of the platform with two in between, equally spaced. The space between the guardrail and platform shall be provided with a side screen.

15. **Needle-Beam Scaffolds** (See Figure 4)

a. When Used. Needle-beam scaffolds shall be used only for the support of men doing riveting and other light work.

b. Dimensions of Wood. Needle beams not more than 12 feet in length between supports shall be not less than 4 inches by 6 inches in size. The greater dimension shall be vertical and should be increased in size when longer or when required for the load they are to support.

c. Intermediate Supports. Long needle beams shall be provided with intermediate supports or hangers.

d. Splicing Prohibited. Needle-beam scaffolds shall always be in one length. Spliced or built-up beams shall never be used.

e. Secured Against Displacement. Needle-beam scaffolds shall be secured against displacement. When one end is supported on the building structure, the overlap for support shall be not less than 6 inches.

f. Used for Rivet Heaters. When needle-beam scaffolds are used for rivet heaters, the platforms shall be the full permissible width of 6 feet and not less than 10 feet long, with planks laid close together and all edges provided with standard toe boards.

g. Specifications for Steel. Steel or wrought iron used for needle-beam scaffolds shall be free from rust or scale. When the scaffold span is not more than 12 feet, pipe beams should be at least 3-1/2 inches in diameter. When more than 12 feet and not more than 16 feet, the diameter should be 4 inches. The diameter should be correspondingly increased with an increase in the span.

h. Rope

(1) Size. Fiber rope 1 inch in diameter or greater shall be used.

(2) Method of Attaching. The ropes shall be attached to the needle beam by a scaffold hitch or a properly made eye-splice looped over the standing part of the rope. The loose ends of the ropes shall be tied to the rope by a bowline knot or a round turn and two half hitches.

(3) Arranging Hitch. The scaffold hitch shall be so arranged that the needle beam will be prevented from rolling or turning.

(4) Space from end of Beam. The rope shall be attached to the beam at a point not less than 1 foot from the end with provision being made to prevent its slipping over the end of the beam.

i. Platforms

(1) Dimensions. Platforms shall be not more than 6 feet wide. When the platform is suspended inside a building it shall be not less than 2 feet 6 inches wide, and when suspended outside a building it shall be not less than 3 feet wide.

(2) Thickness. When the span between needle beams is 12 feet or less, the platform planks shall be 2 inches thick by at least 10 inches wide and increased in thickness as the span increases.

(3) Length of Planks. Platform planks shall be at least 2 feet longer than the span between needle beams.

j. Beams Not of Equal Height. When needle-beam scaffolds are used where one beam is higher than the other, the planks shall be secured against slipping. A hole should be bored through each end of every plank, with a bolt slipped through the hole and provided with a tightly fitting nut. The bolt should be steel not less than 5/8 inch in diameter and not less than 8 inches long. The plank shall be laid with the bolts outside the supporting beams.

1752

MT-PWHD-005359

REDACTED
J-M 83

k. Platform Cleats. When platform planks are used in steeply inclined positions they shall be provided with cleats to prevent slipping thereon. Cleats shall be at least 1-1/2 inch by 2 inches, spaced not more than 8 inches apart and securely nailed to the plank.

l. Burning and Welding. Burning and welding, or the use of blow torch or any open flame shall not be permitted on or near needle-beam scaffolds unless suspension ropes are of steel. The use of fiber rope under these conditions is prohibited.

m. Chafing Pads. Chafing gear (pads) shall be placed on all sharp corners of beams where ropes or slings of steel or manila are used to suspend scaffolds.

16. Outrigger Scaffolds (Suspended Scaffolds)

a. Construction. Scaffolds shall be supported by thrustouts securely attached to the frame of the building. Each thrustout shall be equal in strength to a 6-inch I-beam at 12.25 pounds per foot or a 3 by 10 heavy timber set on edge, and shall not extend more than 6 feet from the building. The inner ends, extending into the building, shall be supported, braced, anchored, and securely fastened in place. (See Figure 10 for illustration.)

b. Guardrail. Heavy outrigger scaffolds shall be provided with standard guardrails supported on uprights and securely fastened to the thrustouts. These uprights shall be long enough to drop 12 inches below the outrigger and the lower end securely braced to it.

c. Toeboard. Standard toeboards and side screens shall be provided.

d. Horse Scaffolds Prohibited. Horse scaffolds shall not be erected upon the platform of an outrigger scaffold.

e. Wall as Support. Outriggers shall not be built into the wall and left with no other support.

f. Bracing. The projecting ends of outriggers shall be supported by external braces and struts when extra support is required. These shall not be depended upon as the main support.

g. Spacing. Thrustouts shall be spaced not to exceed 6 feet on centers.

h. Buckling. The thrustouts shall be rigidly held to prevent turning or buckling.

i. Construction of Platform. The platform shall be constructed of planks 2 by 10 inches securely nailed to the thrustouts and laid close together, except for a 1-inch space along the wall of the building.

j. Projection of Planks. The ends of all planks shall rest on the back of the thrustouts and shall project not more than 12 inches beyond.

k. Suspended Platforms. When working platforms are suspended from the thrustouts, they shall be supported by vertical hangers of not less than 2 by 6 inches and shall not be more than 10 feet long. They shall be securely nailed to the side of the thrustouts and extend at least 10 inches above the top of the thrustouts and to a block resting on the top edge of the thrustouts.

(1) Beams. The suspended platform shall be supported on 2- by 6-inch beams, nailed to the vertical hangers and rest on a block that shall be spiked to the side of the hangers below the beam.

(2) Planks. The suspended platform shall be formed of 2- by 10-inch planks, nailed close together across the back of the bearer and provided with a standard guardrail, toeboard, and side screen protection.

17. Horse Scaffolds (See Figure 5)

a. Rigid Construction. "Horses" used for scaffold purposes shall be rigid and of solid construction.

b. Dimensions

(1) Over-all size. A well-designed horse should have: a spread between the foot of the legs of about 24 inches, a taper in towards the top, a height of about 48 inches. The top horizontal members should be about 48 inches long.

(2) Materials. The following nominal size materials for a well-constructed horse 4 feet long are recommended:

Bearers	3 in. x 4 in.
Legs	2 in. x 4 in.

1753

MT-PWHD-005360

0008 1043 REDACTED J-M 83

Longitudinal brace between legs	1 in. x 6 in.
Gusset brace at top of legs	1 in. x 8 in.
Half diagonal braces	1 in. x 4 in.

(3) Bracing. If the horse is longer or higher than 4 feet, the cross section of the members should be increased and the horse rigidly braced.

c. Extending Legs Prohibited. The nailing of extension pieces on the legs of horses to increase the height is prohibited.

d. Using Shim Pieces. If horses are not the same height, shim pieces shall be used on back of the horses so that all planks will get a solid bearing.

e. Spacing. Horses shall not be spaced more than 4 feet apart for heavy-duty scaffolds nor more than 7 feet 6 inches for a light-duty scaffold.

f. Height of Scaffold. Horse scaffolds shall not be erected more than three tiers of horses nor more than 16 feet high.

g. Placing in Tiers. In erecting successive tiers of horses each horse shall be placed directly over the horse in the tier below.

h. Building up with Bricks or Tile. If a slight increase in the height of a platform is desired, low tiers of brick or tile may be built up on top of the scaffold planks to support the raised platform. This elevation shall be not more than 12 inches. Where this is done, the platform planks should be cleated from below.

i. Foundation of Horses

(1) Strong Flooring. Horses shall not stand directly on the back of beams or joists but shall stand on a strong temporary flooring of planks.

(2) Level Area. All horse scaffolds shall be set on a solid and level foundation, with the legs standing on sections of 2-inch planking and not directly on the earth.

j. Nailed to Planks. On scaffolds more than two tiers high the legs of the horses shall be nailed down to the planks to prevent displacement. The tiers of horses shall be braced together.

k. Support of Planks. Platform planks shall be supported on at least three horses, one at each end and one in the center. Under any circumstance, horses shall be close enough to eliminate spreading and excessive springing of the planks.

l. Laying of Planks. Planks shall be laid so that there is no danger from tipping.

m. Use of Ladders. When ladders are placed against horse scaffolds they shall be located near the horses, the planks against which they rest being firmly nailed down. The horses that support the planks shall also be nailed to the plank upon which they stand.

n. Squares Used as Horses

(1) Hinges. "Squares" hinged together to be used as horses shall be provided with a tie across the bottom to prevent spreading to a distance more than two-fifths the height of the square.

(2) Span. The distance between squares used as horses shall not exceed 12 feet.

o. Toeboards. When it is necessary for the protection of workmen below, a standard toeboard shall be provided on the outer edge and ends of the scaffold.

p. Guardrails. Where horse scaffolds are erected three tiers high, standard guardrails shall be provided on the top tier.

18. Plasterers' Scaffolds

a. When Used. Lathers', plasterers', and decorators' inside scaffolds shall be constructed in accordance with the requirements for pole scaffolds, article 0836.2. They shall be erected when work is to be done which cannot be reached safely from planks supported on ladders.

b. Constructed with Trestle Ladders. When a light-duty portable scaffold is formed of planks supported or hitched on trestle ladders, the base of the ladder shall be secured against opening up to the full spread before laying on the planks.

19. Carpenters' Bracket Scaffolds (See Figure 9)

a. When Used. When bracket scaffolds are used at heights exceeding 12 feet, standard guardrails shall be installed.

b. Dimensions. The brackets shall be built of material of not less than 2 by 3 inches, mortised together and bolted.

1754

MT-PWHD-005361

0008 1044 REDACTED J-M 83

c. **Supporting Bolt.** The supporting bolt shall be not less than 5/8 of an inch in diameter. It should be welded to a flat iron member, not less than 2 feet long, which shall be spiked and set in flush with the top surface of the horizontal member. Length of bolt shall be sufficient to extend well inside the studs (when secured to a frame building) and shall be provided with washer and lever-handled nut.

d. **Length of Bolt.** There shall be at least 2 inches of threaded bolt beyond the nut when screwed up.

e. **Inspection.** The supporting bolt and nut shall be frequently inspected, and renewed when the threads show signs of wear.

f. **Construction.** In erecting a bracket, a 2 by 6 inch block shall be laid horizontally across the inside of two studs, with the bolt passing through the block and screwed up tight.

g. **Strength.** The brackets shall be of sufficient strength to carry a load of 400 pounds on the extreme outer ends.

h. **Spacing.** Brackets shall be spaced not more than 12 feet apart.

i. **Platform.** The platform shall be two planks wide, the plank ends overlapping the bracket not less than 6 inches nor more than 12 inches.

20. **Crawling Boards or Chicken Ladders**

a. **Single or Double.** Where crawling boards (or chicken ladders) are used on roof work, they may be either single or double.

b. **Catch Platform or Lifeline.** When crawling boards are used on a roof where the pitch is more than 3 inches in 1 foot, a catch platform or lifeline shall be provided.

c. **Dimensions.** A single crawling board shall be at least 10 inches wide and not less than 1 inch thick. Cleats as long as the width of the board, and at least 1-1/2 inches wide by 1 inch thick, shall be nailed to the board.

d. **Upper End Secured.** The board shall be laid on the roof so that its length extends from the ridgepole down to the eaves. The upper end shall be securely engaged to the ridge with hooks or fastened with a cleat.

e. **Double Boards.** Where double boards are used, each section shall be made similar to the single board. The two sections should be hinged or bolted together. They shall be laid so that the hinge bolt will rest on the peak or ridge pole.

21. **Ladder Jacks** (See Figure 9)

a. **Specifications**

(1) Types. Ladder jacks shall be of an approved type.

(2) Ladders. Ladders used with ladder jacks shall be designed and constructed in accordance with requirements in article 0835.

b. **Limitation of Use**

(1) Height. Ladder jacks shall not be used at a greater height than 22 feet above the ground or working level.

(2) Number of Persons. Only one person shall be allowed to work on a ladder-jack scaffold at any one time.

(3) Not to be Used With Extension Ladders. Ladder jacks shall not be used on extension ladders.

c. **Safety Feet.** Ladders used with ladder jacks shall be placed and secured to prevent slipping. In addition, ladders should be equipped with safety feet.

d. **Platforms**

(1) Overlap. Platform planks should overlap the bearing surface at least 4 inches but not more than 8 inches.

(2) Span. Platform planks shall not have a greater span than 10 feet unless provided with a center support.

(3) Clamping. The ladder jack shall be clamped or otherwise securely fastened to the platform and shall bear on the side rails.

22. **Roofing Brackets**

a. **Construction.** Roofing brackets shall be triangular in shape, formed of three pieces of 2- by 4-inch material. The diagonal member should be sloped to fit the pitch of the roof and the horizontal member leveled to support the plank.

b. **Supports.** Roof brackets shall be securely supported by means of ropes fastened at one end to a hook securely hooked over the ridge pole and, at the other

1755

MT-PWHD-005362

end, to a 5/8-inch eye bolt securely screwed into the roofing bracket; or by means of pointed projectors driven their full length in the frame or woodwork of the roof. The ropes may also be secured to chimney or roof members or other solid objects on the other side of the roof.

c. Catch Platform. When work is done on roofs which are more than 20 feet from the ground to the eaves, and when there is no parapet wall at the eaves, and such roof has a slope greater than 3 inches in 1 foot, a substantial catch platform should be provided. Catch platforms should be of sufficient width to extend at least 2 feet beyond the outer edge of the eaves. In addition, the platform should be equipped with a standard guardrail.

d. Lifeline. As an alternative to such a platform, each man working on the roof should be provided with a lifeline securely fastened to a fixed anchorage.

23. Window Jack Scaffolds (See Figure 9)

a. When Used. Window jack scaffolds shall be used only for the purpose of working at the window opening, through which the jack is placed.

b. Only One Person Permitted. One person only is permitted on the scaffold at any one time.

c. Working Load. Window jacks shall be constructed to sustain a working load of at least 200 pounds with a safety factor of four.

d. Anchoring to Structure. Window jacks shall be securely anchored to the structure.

e. Use of Window Jacks. Window jacks shall not be used as the supporting element of scaffolds.

f. Planks Between Window Jacks. The placing of planks between window jacks is prohibited.

The following illustrations appear through the courtesy of the Chief of Engineers, United States Army.

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MT-PWHD-005363

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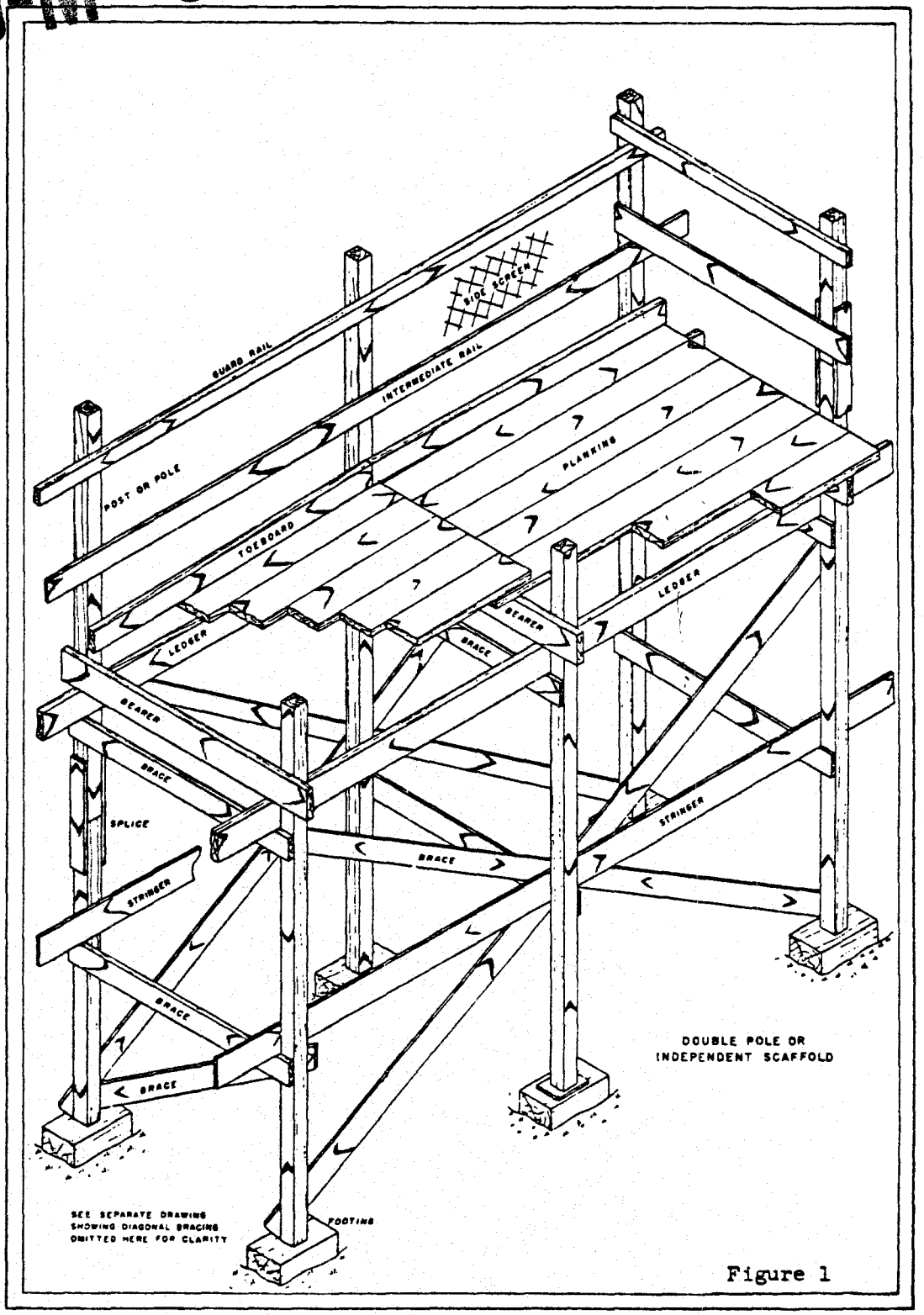
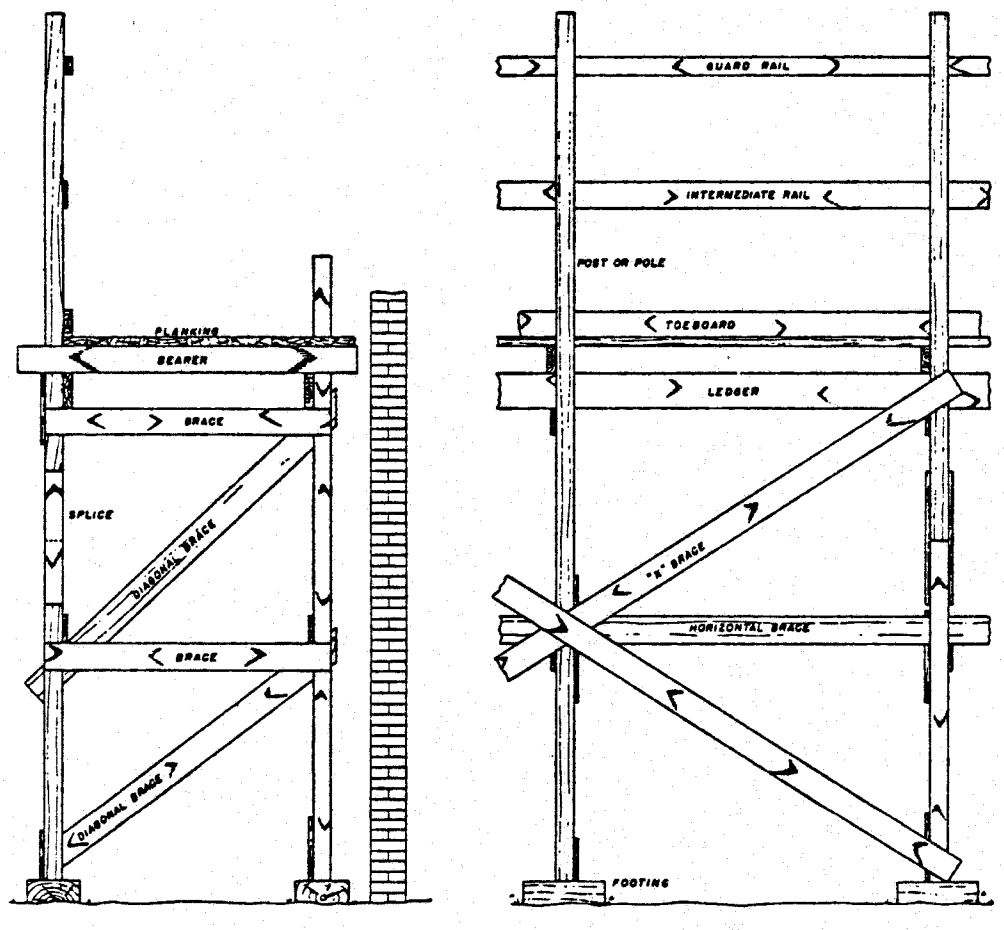


Figure 1

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DOUBLE POLE OR
INDEPENDENT SCAFFOLD

Figure 2

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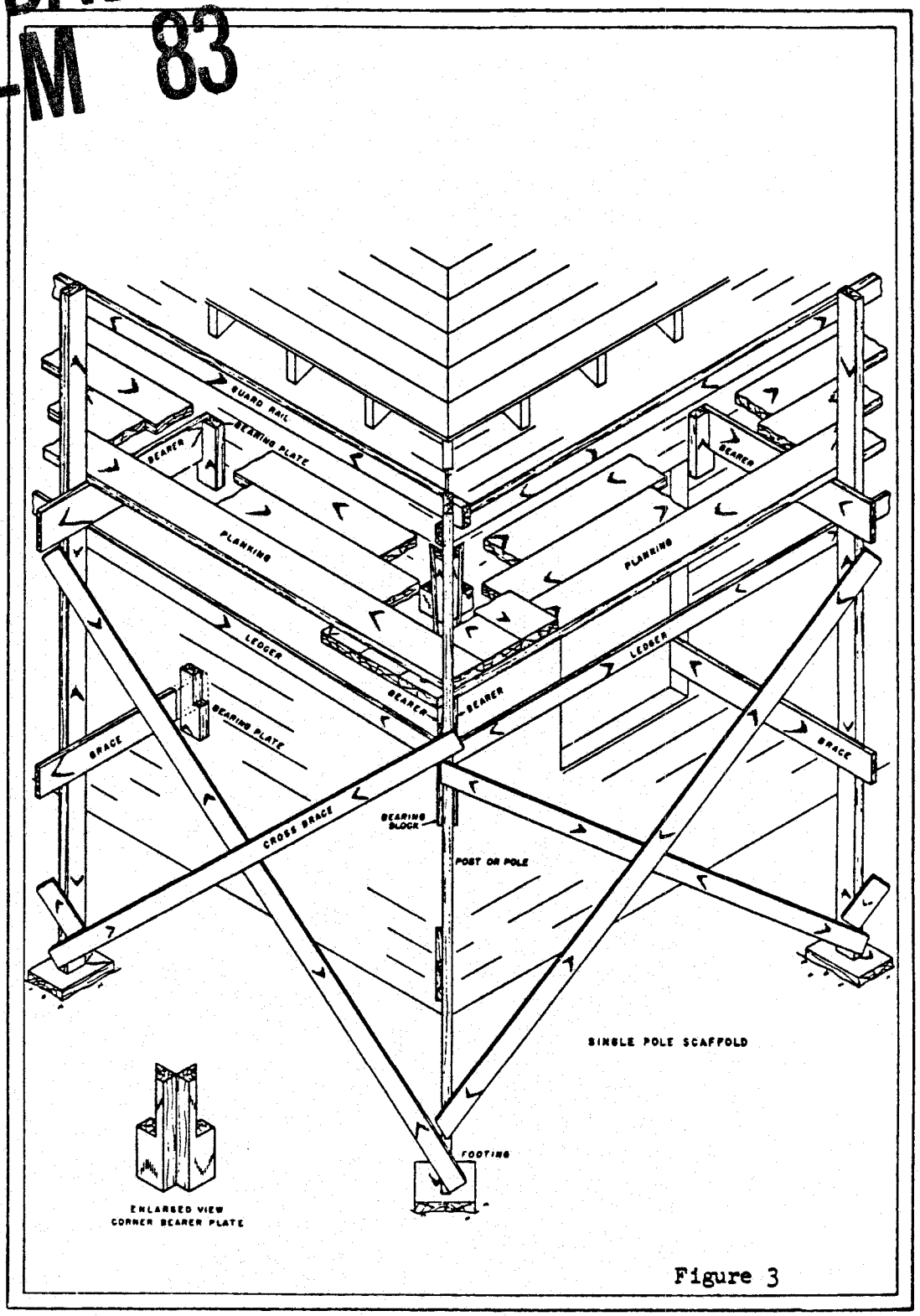


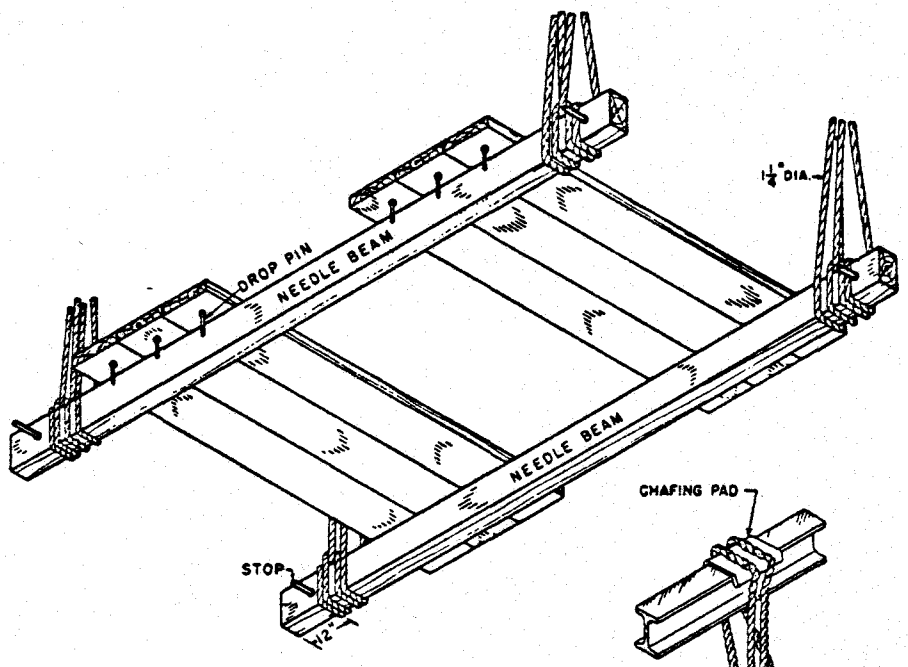
Figure 3

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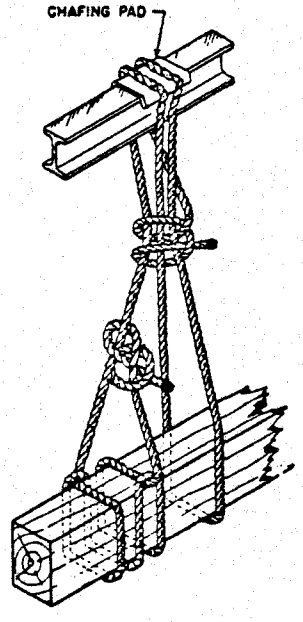
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NEEDLE BEAM SCAFFOLD



ENLARGED VIEW
SCAFFOLD HITCH
AND FASTENING

Figure 4

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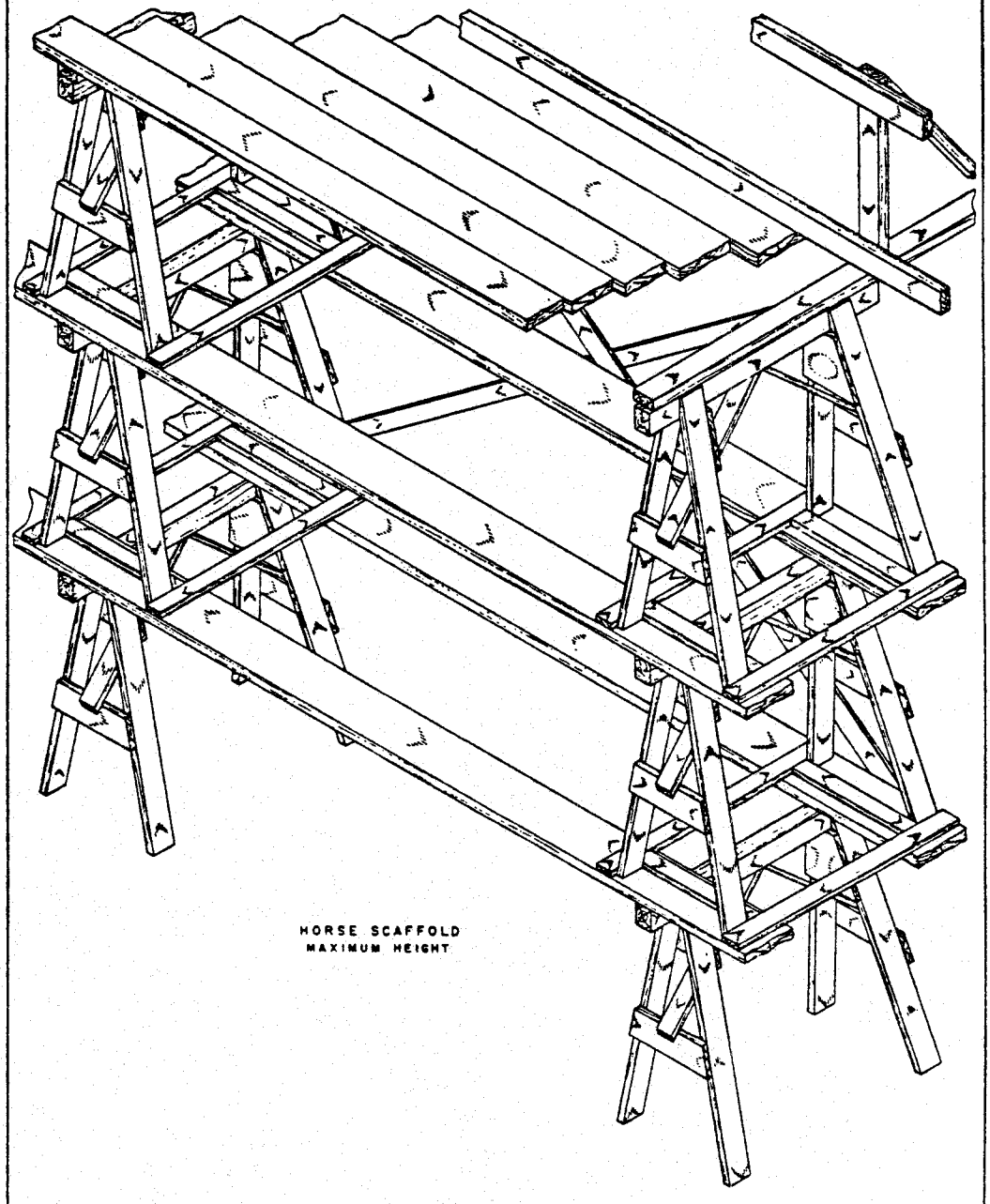


Figure 5

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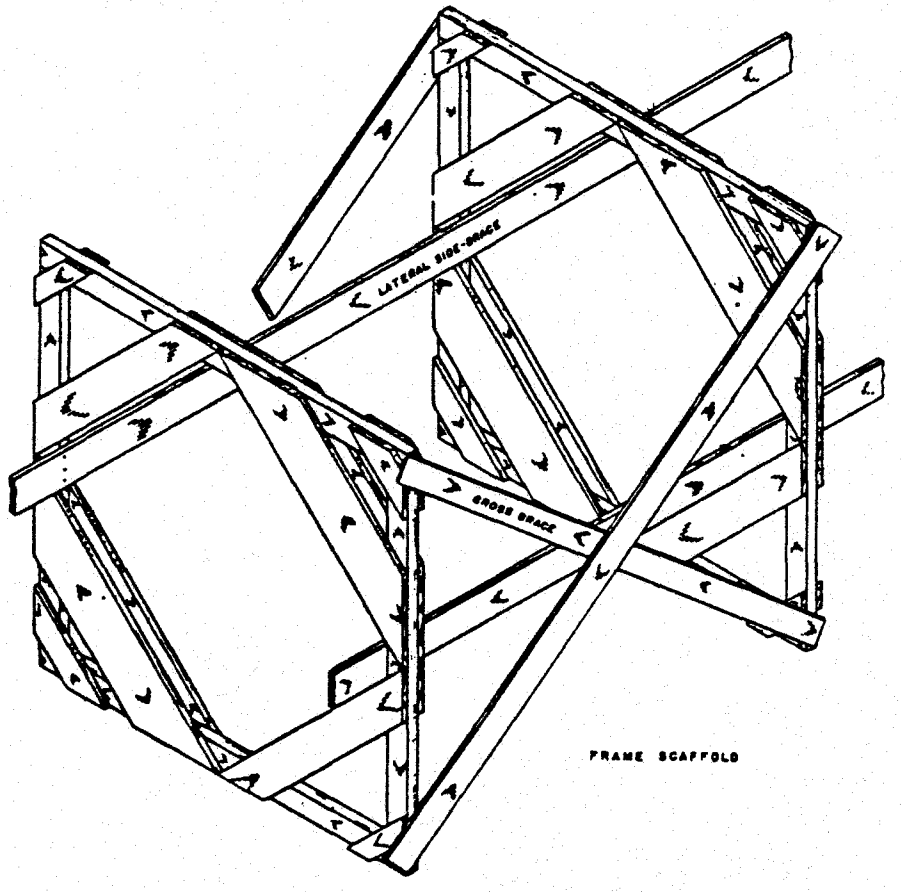


Figure 6

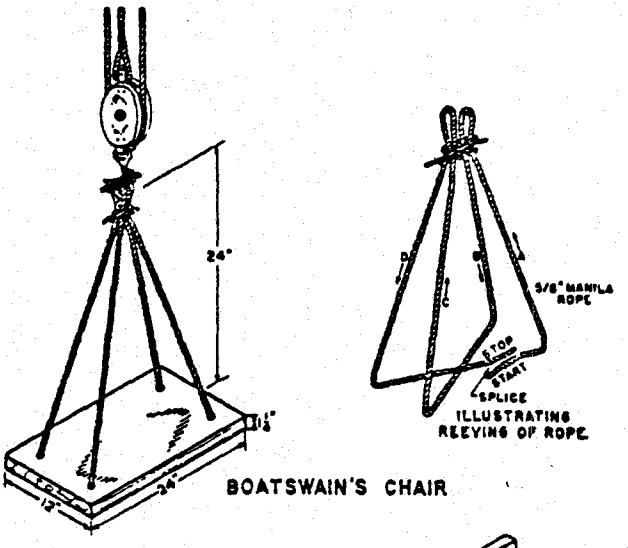
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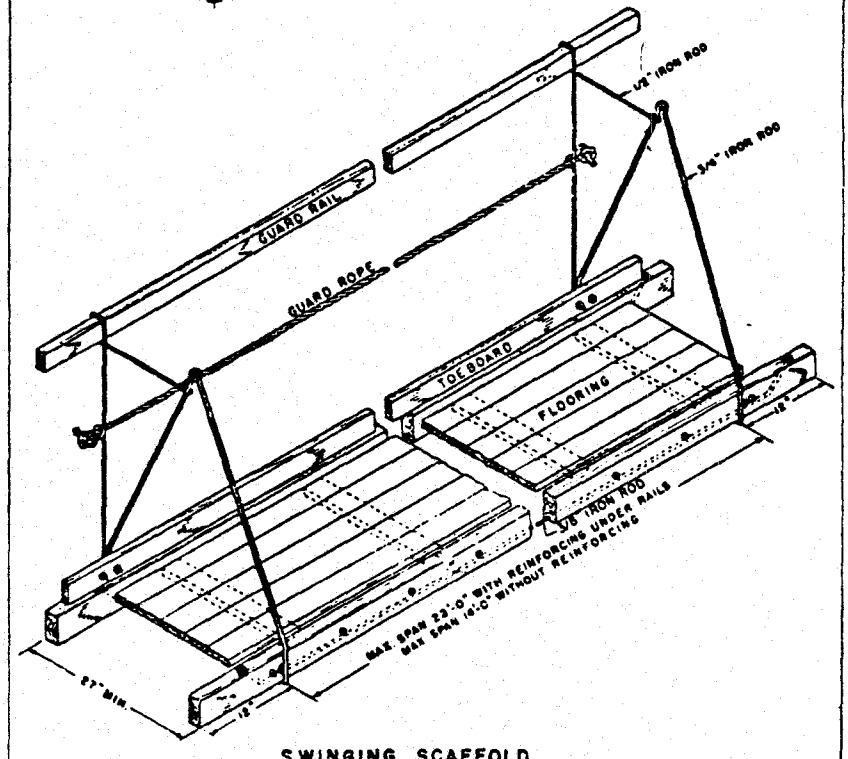
Construction

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J-M 83



BOATSWAIN'S CHAIR



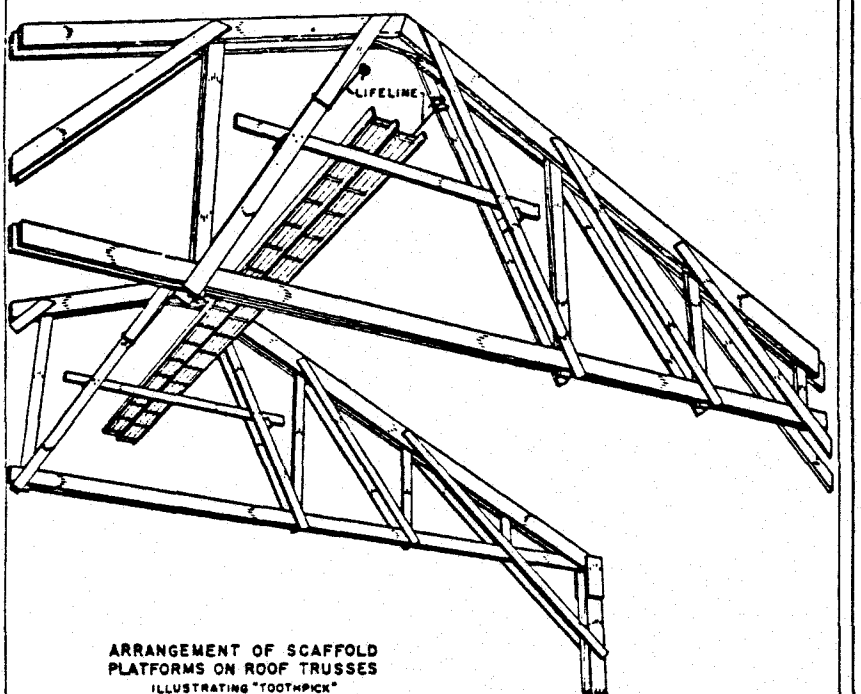
SWINGING SCAFFOLD
LADDER PLATFORM TYPE

Figure 7

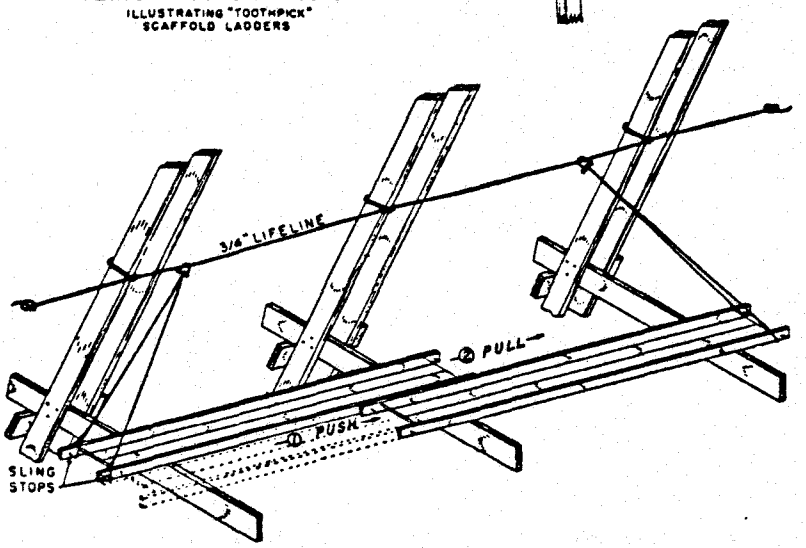
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ARRANGEMENT OF SCAFFOLD
PLATFORMS ON ROOF TRUSSES
ILLUSTRATING "TOOTHPICK"
SCAFFOLD LADDERS



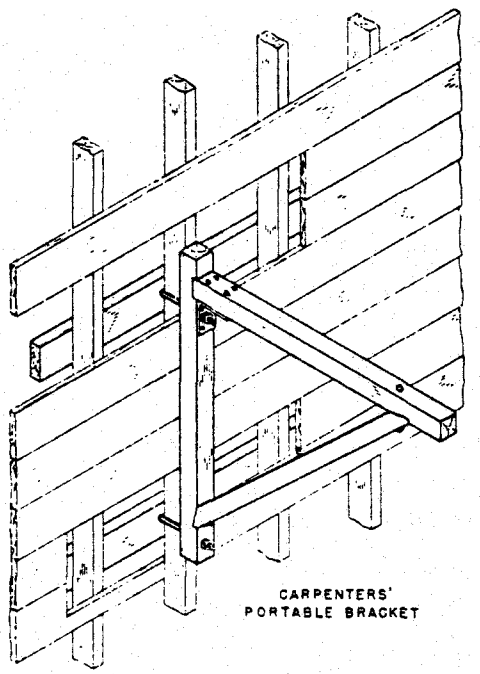
ILLUSTRATING USE OF LIFELINE
FOR MOVING SCAFFOLD PLATFORMS

Figure 8

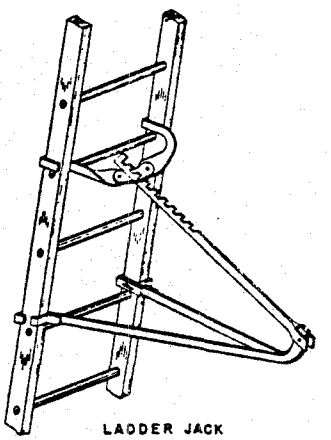
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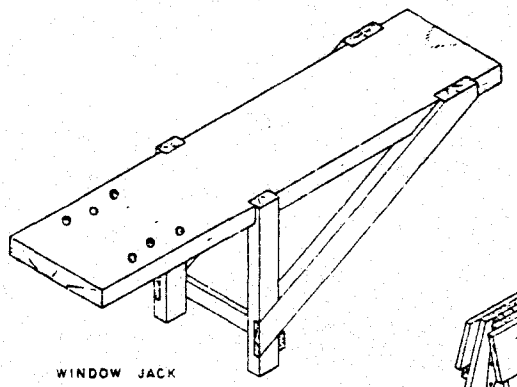
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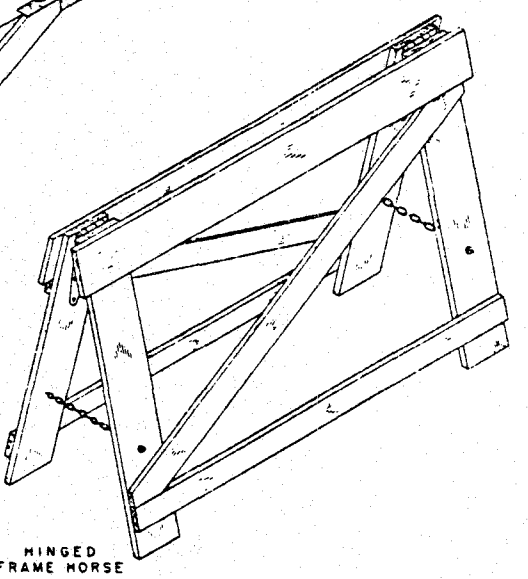
CARPENTERS' PORTABLE BRACKET



LADDER JACK



WINDOW JACK



HINGED FRAME HORSE

Figure 9

MT-PWHD-005372

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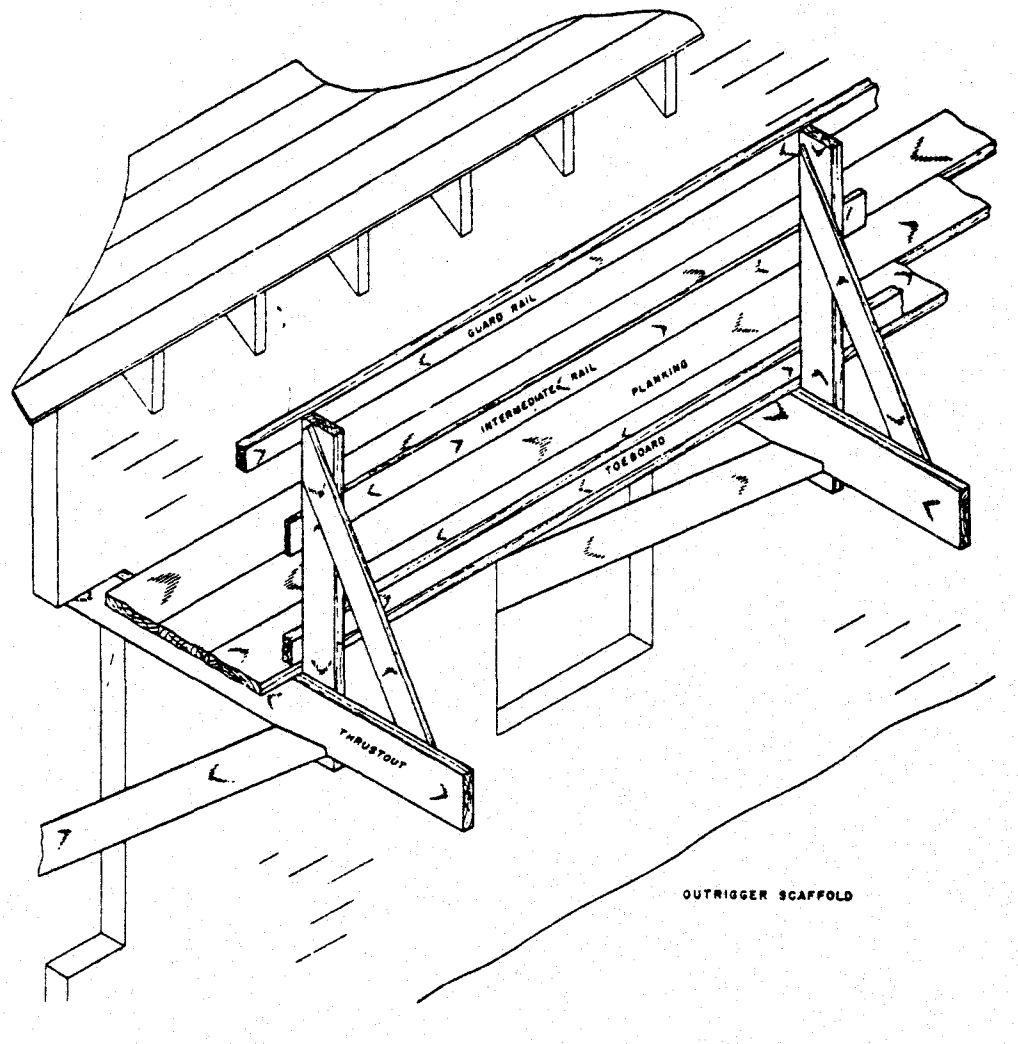


Figure 10

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DEMOLITION

0840. GENERAL

1. Regulations and Codes. Where applicable, federal, state, and local codes, rules, regulations, and ordinances governing any and all phases of demolition work shall be observed at all times. The safety precautions herein stated apply wherever demolition by the "piece-by-piece" method is undertaken.

2. Overloading. No structure, or part of a structure, of any floor or temporary support, or scaffold, sidewalk, shed, or bridge, or any device or piece of equipment shall be loaded in excess of its safe carrying capacity.

3. Walkways. Walkways and passageways shall be provided for the use of the workmen, who shall be instructed in their use. All such walkways and passageways shall be kept adequately lighted and free from debris and other materials.

4. Protruding Nails. Protruding nails in any kind of lumber shall be withdrawn, hammered in, or bent over as soon as such lumber is removed from the structure being demolished; or all nail-bearing lumber shall be placed in piles for future cleaning or burning.

5. Dust. During the demolition operation, the work shall be sprinkled regularly to keep the dust to a minimum.

6. Protective Apparel. Gloves should be worn. All workmen exposed to the danger of falling objects shall wear hard hats.

7. Goggles. Approved type safety goggles shall be worn to protect the eyes against injury from flying pieces and from dirt and dust blown by the wind. Workers using jack hammers shall wear safety goggles.

8. Respirators. If the operations are dusty, demolition workers shall also wear approved respirators.

9. Protective Equipment. Only Navy approved personal protective equipment as described and illustrated in the *Safety Equipment Manual,* NAVEXOS P-422, is authorized.

0841. WARNING SIGNS AND LIGHTS

1. Dangerous Areas. On every demolition job, *danger* signs shall be conspicuously posted around the property; all doorways or thoroughfares giving access to the property shall be kept barricaded except during the actual passage of men or equipment.

2. Barricades. Exterior wall openings which extend down to floor level shall be barricaded to a height not less than 3 feet above floor level when the debris requires such action.

3. Guard Rails. Floor openings and shafts not used for material chutes or workers' entrances shall be floored over or enclosed with guardrails and toeboards.

4. Flares. During the hours of darkness, red lights, flares, reflectors, or fluorescent warning devices shall be placed on or about all barricades.

5. Watchmen. When operations are not in progress, a watchman or watchmen shall be stationed to prevent the public from entering the danger zone and to maintain all danger signs, lights, and barricades.

0842. PREPARATION OF LOCATION

1. Electric Power. The power on all electric service lines shall be shut off and all such lines shall be cut or disconnected at or outside the limits of the site before demolition work is started. Prior to the cutting of such lines, the approval or cooperation of the local electric service company shall be obtained.

2. Gas Service. Before starting demolition work, gas service shall be cut off and gas lines capped, with the approval or cooperation of the local gas service company.

3. Protection of Power Lines. If it is necessary to maintain power, water, steam,

MT-PWHD-005374

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J-M 83

or other lines during demolition, such lines shall be temporarily relocated or protected with substantial covering to the satisfaction of the local utility companies and in accordance with codes and legal requirements.

4. **Glass.** Glazed sash and glazed doors and other glass fixtures shall be removed before other demolition work is started.

5. **Shoring.** If a structure to be demolished is considered to be insecure, the walls shall be shored or braced in accordance with the requirements of the authorities having jurisdiction, or in the absence of such requirements, in accordance with accepted engineering practice, before any demolition work is started.

0843. SIDEWALK SHEDS

1. **Public Thoroughfares.** Before any demolition work is commenced, every sidewalk or public thoroughfare adjacent to the work site shall either be closed or protected as specified elsewhere in this section. Such thoroughfares which are open to the public shall be kept clear and unobstructed at all times.

2. **When Required.** If a structure to be demolished is more than 2 stories or 25 feet high, measured from sidewalk or (if there is no sidewalk) from the street level, and if the horizontal distance from the inside of the sidewalk to the structure is 15 feet or less, a substantial sidewalk shed shall be constructed over the entire length of the sidewalk adjacent to the structure, of sufficient width to accommodate pedestrian traffic without causing congestion.

3. **Lighting.** Sidewalk sheds shall be lighted either by natural or artificial means sufficient to ensure safety at all times.

4. **Load Capacity.** Every sidewalk shed shall be capable of safely sustaining a minimum load of 150 pounds per square foot, and if material is to be stored thereon, the shed shall be capable of sustaining the load to be imposed.

5. **Fencing.** Unless the top deck of the sidewalk shed is built solidly against the face of the structure to be demolished, the vertical face of the shed supports next to the building shall be solidly fenced throughout. This shall not prohibit the construction and use of such solid sliding or swinging gates as may be necessary for the prosecution of the work.

6. **Enclosing Roof.** The outside edge and ends of the roof of the shed shall be provided with a substantial enclosure of at least 42 inches above the shed. Such enclosures may be vertical or inclined outward at approximately 45 degrees and shall consist of boards laid close together secured to braced uprights, or toeboards and galvanized wire netting formed of not less than No. 16 U.S. gage wire and one and one-half inch mesh.

7. **Loading Passages.** Sidewalk shed openings for loading purposes shall be kept closed at all times except during actual loading operations.

8. **Specifications for Shed Roof.** The roof of a sidewalk shed shall consist of planking not less than 2 inches in thickness, closely laid, and shall be made watertight through the use of tar paper roofing or similar material. All members of the shed shall be adequately braced and connected to resist displacement of members or distortion of the framework.

9. **Fences.** When the horizontal distance from the inside of the sidewalk to the structure is more than 15 feet but less than 25 feet, a substantial fence may be constructed along the inside of the walk in lieu of a sidewalk shed. If permission has been granted to close the sidewalk, the fence may be constructed along the inside edge of the roadway. The fence shall be at least 6 feet high, of wood or other suitable material, and shall be built solid for its entire height and length except that openings necessary for the proper prosecution of the work may be provided with solid sliding or swinging gates.

10. **Railings.** When the horizontal distance from the inside of the sidewalk to the structure is more than 25 feet, it is permissible to construct a substantial railing in lieu of a

1768

MT-PWHD-005375

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fence on the inside of the walk or roadway, with the necessary access gates. If permission has been granted to close the sidewalk, the railing may be constructed along the inside edge of the roadway.

11. **Canopies.** Where workers' entrances to buildings being demolished are not completely protected by sidewalk sheds, all such entrances shall be protected by canopies extending from the face of the building to a point not less than 8 feet from it. In each case such overhead protection shall be at least 2 feet wider than the building entrance or opening and every canopy shall be at least as strong as the sidewalk shed described in paragraph 8 of this article.

0844. REMOVAL OF MATERIALS

1. **Gloves.** Workmen removing materials shall wear leather gloves.

2. **Dropping Material.** No material shall be dropped to any point lying outside the exterior walls of the building except through enclosed wooden or metal chutes.

3. **Enclosing Chutes.** All material chutes which are at an angle of more than 45 degrees from the horizontal shall be entirely enclosed on all four sides except for openings at or above floor level for the receiving of materials.

4. **Specifications for Chutes.** Openings as specified in paragraph 3 above, shall not exceed 48 inches in height measured along the wall of the chute, and in all stories below the top floor such openings shall be kept closed when not in use.

5. **Angle of Chute.** Chutes at an angle of less than 45 degrees with the horizontal may be left open on the upper side, provided that at the point where such a chute discharges into a chute steeper than 45 degrees with the horizontal, the upper side of the steeper chute is boarded over to prevent the escape of material.

6. **Gate at Chute.** A strong gate shall be installed in each chute at or near the discharge end and a reliable employee shall be designated to control the gate and the backing up and loading of trucks.

7. **Protection of Passersby.** A designated employee shall be instructed to prevent any person from standing or passing under the discharge end of the chute.

8. **Guarding Chute**

a. **Bottom.** When operations are not in progress, the danger area at the discharge end of each chute shall be completely enclosed with a substantial fence, or otherwise made inaccessible.

b. **Top.** Chute openings into which workmen dump debris shall be guarded by a substantial guardrail extending at least 36 inches above the level of the floor or other surface on which men stand to dump material into chutes.

0845. STAIRS, PASSAGEWAYS, AND LADDERS

1. **Access to Building.** With the exception of stairways, passageways, and ladders for the use of workmen, access to the building being demolished shall be entirely closed off at all times.

2. **Securing Ladders.** All ladders shall be secured against slipping out at the bottom, and against movement of any kind at the top.

3. **Safe Condition.** All stairs, passageways, and ladders used by workmen shall be maintained in a safe condition. (See article 0835 for special precautions concerning the specifications for and use of ladders.)

0846. REMOVAL OF WALLS

1. **Order of Demolition.** Except for the cutting of holes in floors for chutes and holes through which to drop materials, the preparation of storage space, and other necessary preparatory work, demolition of exterior walls and floor construction shall begin at the top of the structure and proceed downward, and each story of exterior wall and floor construction shall be removed and dropped into the storage space before commencing the removal of walls and floors in the story next below. This requirement shall not prohibit the demolition of a structure in vertical sections so long as positive means are taken to prevent injury to persons or damage to property.

MT-PWHD-005376

0008 1058 REDACTED J-M 83

2. Overloading Floors. Masonry walls or other sections of masonry shall not be permitted to fall upon the floors of the building in masses that exceed the safe carrying capacity of the floors.

3. Lateral Bracing. No section of wall whose height is more than 22 times its thickness shall be permitted to stand without lateral bracing unless such wall is in good condition and was originally designed to stand to a greater height without such lateral support.

4. Hazardous Weather. Workmen shall not be permitted to work on top of a wall when weather conditions constitute a hazard.

5. Load-Supporting Members. Structural or load-supporting members on any floor shall not be cut or removed until all stories above that floor have been demolished and removed. This provision shall not prohibit the cutting of floor beams for the purpose of removal of materials, as stated in article 0844, or for the installation of equipment; nor shall it prohibit the removal of intermediate steel floor beams not required for the stability of the structure.

6. Openings in Floor. Before demolishing any interior or exterior wall which is within 10 feet of any opening in the floor immediately below, such opening shall be substantially planked over unless all workmen are removed from all floors below and access to such floors is positively prevented.

7. Steel Framing. In buildings of "skeleton" construction, the steel framing may be left in place during the demolition of masonry work. Where this is done, steel beams, girders, and the like shall be cleared of all loose material as the masonry work progresses downward.

8. Walkways. Walkways shall be provided to enable workmen to reach or leave their work on any scaffold or wall. Such walkways shall be not less than 30 inches wide.

9. Stability of Remaining Walls. At the completion of each day's work, all walls shall be left stable and in no danger of being overturned.

0847. CATCH PLATFORMS

1. Where Used. During the demolition of the exterior walls of a structure originally more than 70 feet high, catch platforms shall be erected along the exterior faces of such walls where necessary to prevent injury to the public and to men working below.

2. Three-Story Limit. Such catch platforms shall be constructed and maintained not more than three stories below the story from which the exterior walls are being removed. When the demolition has progressed to within three stories of ground level, catch platforms will not be considered necessary.

3. Limitation of Use. Materials shall not be dumped on catch platforms nor shall such platforms be used for the storage of materials.

0848. REMOVAL OF FLOORS

1. Definition. In the following paragraphs the term "floor arches" shall apply to the masonry filling between the floor beams and girders irrespective of the type of floor system.

2. Width of Section. In cutting holes in floor arches which span in one direction between two beams or supports, the section of floor arch to be removed in making such hole may be of any width and shall include the entire span of the floor arch which is between the two beams or supports on which it bears.

3. Supporting Planks. When workmen are engaged in removing floors, planks of ample strength (not less than 2 inches thick by 10 inches wide) shall be provided and used by workmen breaking down floor arches. The planks shall be so placed as to give the workmen firm support should the arch collapse unexpectedly. If it is necessary for a workman to straddle a space between two planks, such space shall not exceed 16 inches.

4. Walkways. Walkways not less than 30 inches wide formed of planks of ample

1770

MT-PWHD-005377

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strength (not less than 2 inches thick by 10 inches wide) shall be provided and used by the workmen when necessary to enable them to reach any work place without walking on exposed beams.

5. **Stringers.** Stringers of ample strength shall be installed to support the planks where necessary and the ends of such stringers shall be supported by floor beams or girders and not by floor arches alone.

6. **Barricades.** When floor arches are being removed, no workmen shall work in the area directly underneath and such area shall be barricaded to prevent access to it.

7. **Clearing Floor Area.** The demolition of floor arches shall not be started until they and the surrounding floor area for a distance of 20 feet have been entirely cleared of debris and other unnecessary material.

0849. DEMOLITION OF STEEL CONSTRUCTION

1. **Planking Derrick-Supporting Beams.** When floor arches have been removed, the entire tier of beams on which any derrick is supported shall be completely planked over except for such openings as are required for handling material or equipment.

2. **Signal System.** In the operation of cranes and derricks, a standard signal system shall be used and all men assigned to the operation of such equipment shall be fully instructed in the proper use of these signals.

3. **Tag Lines.** A tag line or guide rope should be used on all hoisted or lowered loads.

4. **Riding Load.** The riding of the load line in any lifting device is prohibited.

5. **Protection of Eyes.** Where it is necessary to do any burning with acetylene, welders' goggles of approved type (article 1011) shall be worn by the workmen so engaged.

6. **Lifting Acetylene or Oxygen Tanks.** Whenever acetylene or oxygen cylinders are transported or lifted by crane or derrick, such cylinders shall be placed in substantial stands or cradles in an upright position.

7. **Swinging Beams.** No beam shall be cut until precautions have been taken to prevent it from swinging freely and possibly striking any worker or any piece of equipment or any part of the structure being demolished.

8. **Lowering Steel.** All structural steel shall be lowered from the building; it shall never be allowed to drop.

BLASTING

0855. GENERAL

1. **Trained Personnel.** The handling, storage, and use of explosives shall be directed by persons of proved experience and ability in blasting operations, and shall conform with Bureau of Naval Weapons and station regulations and with the requirements of state and municipal authorities having jurisdiction. Precautions for transportation of explosives will be found in article 0517. Rough handling, careless stowage, and similar improper treatment of explosives can lead to serious explosions and accidents. Supervisory personnel engaged in or responsible for blasting operations should be familiar with the practices described in *The Blaster's Handbook*, published by E. I. DuPont De Nemours and Co., Inc.

2. **Permission to Use Explosives.** Permission shall be obtained from the Government representative, commanding officer, or his representative-in-charge before explosives are brought on the job or station premises. (See Army Corps of Engineer's Manual EM-385-1-1.)

MT-PWHD-005378

0008 1061

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J-M 83

3. **Review of Plans.** Plans for use of explosives shall be reviewed by the Government representative in consultation with the safety staff of the activity prior to granting permission to use explosives for blasting purposes.

4. **Use of Intoxicants.** No person addicted to the use of, or under the influence of intoxicants or narcotics shall transport, handle, stow, or otherwise use explosives.

5. **Smoking.** Personnel actively engaged in the transportation, handling, stowage, or use of explosives shall not smoke or carry matches, cigarette lighters, or other flame-producing devices on their person or in a vehicle containing explosives.

6. **Personnel Kept to a Minimum.** The number of personnel engaged in handling explosives and the number present in the vicinity of the place where explosives are in use shall always be kept to a minimum.

0856. STOWAGE AND HANDLING OF EXPLOSIVES

1. Magazines

a. **Construction and Location.** Explosives, detonators, and fuzes shall be stowed in bullet-proof, fire-resistant, and weather-proof magazines constructed in accordance with standard designs established by the Bureau of Yards and Docks. The allowable locations of these magazines with relation to other magazines and buildings shall be in accordance with the current quantity-distance tables supplied by the Bureau of Naval Weapons.

b. **Surrounding Area.** The ground around the magazine shall be kept free of brush and dry leaves. A fence, preferably of barbed wire, should be maintained around the magazine area.

c. **Use for Other Purpose.** Magazines in which explosives are stowed shall not be used for any other purpose. Miscellaneous material shall not be stowed in these magazines.

2. **Shoes with Nails.** Shoes with nails or metal plates that would cause friction sparks shall not be worn in a magazine or around explosives.

3. **Order of Use.** Stowed explosives shall be used in the order of their delivery.

4. **Angle of Stowage.** Boxes of explosives should be stowed so that the cartridges will lie flat and not stand on end.

5. **Dynamite**

a. **Use Prohibited When Frozen.** No attempt shall be made to use dynamite that is frozen.

b. **Blasting Caps.** Under no circumstances shall blasting caps be taken into magazines containing dynamite, either for stowage or for use in making up primers.

c. **Detonators.** Detonators shall never be stowed in the same magazine with other explosives such as powder or dynamite.

6. **Cartridges Discolored.** Any cartridges showing nitroglycerine, crystal, or stains on the outside shall not be used.

7. **Temperature and Humidity.** Buildings in which fuze is stowed should be dry; the temperature should be kept between 45 degrees F and 100 degrees F. Stowing fuze in a damp place retards its burning speed, and fuze that is stowed underground is never in prime condition.

0857. DRILLING

1. **Size of Hole.** All drill holes shall be of sufficient diameter throughout their length to permit free insertion of a cartridge without the necessity of undue ramming or of removing the original wrapper from the dynamite.

2. **Preparation.** The holes shall be made ready before the dynamite is brought to the work and the operations of priming, charging, tamping, and firing carried on with a minimum of man exposure and as rapidly as is consistent with careful work.

3. **Deepening Hole.** Holes that have previously contained explosives shall not be deepened.

4. **Inspection of Old Holes.** Drilling shall not be started until all remaining butts of old holes are examined for unexploded charges.

1772

MT-PWHD-005379

0008 1062 REDACTED J-M 83

5. **Unexploded Charges.** Drilling shall not be resumed after blasts have been fired until a thorough examination has been made to make sure that no charges remain unexploded.

0858. PORTABLE AIR COMPRESSORS

1. **Hose Connections.** The hose connections of portable air compressors must be kept tight. These connections shall be inspected frequently to be sure that they stay tight in service.

2. **Safety Valves and Gages.** The safety valves and gages shall be checked frequently so that there will be no doubt that they are in good operating condition.

3. **Towing Equipment.** Fixed tow bars shall always be used when transporting this equipment. Chains and ropes shall not be employed when moving it from place to place. This equipment shall not be towed at a speed beyond that for which the wheel bearings are designed.

4. **Carriage Wheels.** The wheels of portable air compressor carriages shall be checked regularly to be sure they will operate safely when they are used.

5. **Air Receivers and Compressors.** All the usual safety aspects of motors, air compressors, and air receivers must be considered to assure safe operation of this type of equipment. (See articles 0735-0737.)

0859. LOADING CHARGES

1. **Tamping.** In loading small diameter bore holes, tamping shall be done with a wooden stick having no metal parts, and pressure shall be exerted only when necessary. Quick sharp blows shall never be used.

2. **Locating Charges.** All holes or charges shall be checked and definitely located before firing.

3. **Springing Charges.** Electric detonators should be used for springing charges. The use of short pieces of fuse may result in the charge exploding before the blaster is a safe distance away from the hole. When holes are sprung, leave ample time between springing shots for the hole to cool, and also between the last springing shot and the loading of the main charge.

4. **Loading Near Drilling Prohibited.** Provision shall be made to segregate drilling from loading operations.

0860. PREPARATION FOR FIRING

1. **Selection of Fuse.** A fuse shall be selected which conforms to the condition existing on the operation. Where wet drilling is being done, a tape-covered fuse shall be used, the grade depending upon conditions of temperature and moisture. Where acid is present in sufficient quantity to make it necessary to line pumps with acid-resisting materials, a triple-tape fuse should be used, the kind depending upon conditions of temperature and moisture.

2. **Burning Rate.** The burning rate of a fuse shall be determined prior to its use. This may be done by timing the burning rate of a sample length of fuse (6 feet).

3. **Crimping Tool.** Caps shall be fastened to fuses by means of crimping tool made especially for that purpose. The use of the teeth or a knife or pliers is prohibited.

4. **Vertical Shafts.** No blast shall be fired with fuse in vertical or steep shafts.

5. **Number of Charges.** When 10 or more explosive charges are to be loaded and shot at one time, they shall be fired electrically; fewer than 10 explosive charges to be loaded and shot may be fired by cap and fuse.

6. **Blasting Mattress.** Before a charge is fired, the rock or other substance to be shattered shall be covered with a blasting mattress or other means, if necessary, to protect workmen, the public, or property from injury or damage from flying rocks.

7. **Warning.** When a shot is about to be fired, all persons near the place shall receive ample warning and the fuse shall not be lighted or the blast detonated until it is absolutely certain that every person has re-

MT-PWHD-005380

0008 1063 REDACTED J-M 83

treated to a safe distance (not less than 500 feet). The blaster in charge is responsible for posting signalmen and guards to keep vehicles and persons out of the vicinity just prior to the blast.

8. **Shelter.** Definite places of shelter, if available, shall be assigned to various crews of workmen, and supervisors shall be responsible for seeing that men go to designated shelter.

0861. BLASTING MACHINES

1. **Care of Blasting Machine.** Care must be taken to make sure that the blasting machine is in good working order and of sufficient capacity to fire all shots in the series. The machine should be kept dry; it should not be left outside or underground in a shaft or tunnel overnight.

2. **Testing.** A blasting machine shall be tested daily when in use and kept in good mechanical condition.

3. **Preliminary Trial.** The blasting machine should always be tested with a rheostat before operation. It should be operated a few times before making connections; that procedure will make it possible to generate more current.

4. **Connecting Leads.** No leads shall be connected to a blasting machine until just before the shot is to be fired and all exposed persons have taken shelter.

5. **Final Connection.** In electric blasting, the blaster in charge shall personally make the final connection and the charge shall be fired by him personally or on his order.

0862. ELECTRICAL WIRING

1. **Voltage.** When blasting is done by electricity from power circuits the voltage shall not exceed 250 volts.

2. **Exclusive Use.** Wiring circuits for blasting shall not be used for other current-carrying purposes.

3. **Overhead Wires.** Blasting circuit wires shall not cross under overhead electrically charged wires.

4. **Safety Switches.** Blasting operation controls shall consist of two safety switches (a safety switch and a firing switch) located at least 6 feet apart. Connection between the switches is to be made by a "plug in" jumper which cannot be plugged into the firing switch without unlocking it and which must be removed to lock the switch.

5. **Locking Switches.** Switches shall both be of a locking, double-pole, double-throw type, and they are to be opened and locked in the downward position, which short circuits the leading wires when in the open position. The jumper may be permanently attached to the safety switch.

6. **Testing of Circuits.** Blasters shall test wiring circuits through charged holes only with approved types of galvanometers, that is, those complying with the current edition of Federal Specification W-B-411. No tests of circuits in charge holes shall be made until men are removed to a safe distance. Lead wires shall be of sufficient length to permit testing from a safe distance. If electric detonators are used, the leads of these devices shall be short circuited by twisting the naked ends together and shall remain so twisted until ready to be connected to the firing line.

7. **Electrical Firing.** The blaster will avoid trouble in electrical firing by following these rules:

a. Tight connections must be made.

b. There must be no short circuits or breaks in the wires.

c. A series connection should always be made when firing with a blasting machine.

d. Detonators or relays from different manufacturers should not be used in the same series.

e. Care should be taken not to damage the insulation of wires when tamping charges.

f. Plenty of time should be taken to check the wiring before firing. Before attempting to fire, the circuit should be tested with a blasting galvanometer to see that the resistance is correct.

MT-PWHD-005381

0863. INSPECTION AFTER BLASTING

1. **Disconnecting Lead Wires.** After a blast has been fired electrically the lead wires shall be immediately disconnected from the blasting machine or the switch box and carried back at least half the distance to the area of the blast. All wires shall be carefully traced and a search made for unexploded charges.

2. **Waiting Period.** At least 15 minutes shall elapse before investigation of the blasting site shall begin. After this waiting period and after smoke and fumes have cleared to permit good visibility, a thorough inspection shall be made by or under the direction of the blaster to determine whether all charges have been exploded. No other persons shall be allowed to enter the danger zone until the inspection has been completed.

3. Misfire with Cap and Fuse. If cap and fuse are used, the blaster shall not return to a misfire until at least 1 hour has elapsed, or such longer time as may be required by regulations of authorities having jurisdiction.

4. **Entering Danger Zone.** If unexploded charges are discovered, no persons other than those required to handle such misfires shall be allowed to enter the danger zone until the charges have been fired or otherwise destroyed.

0864. MISFIRES

1. **Blaster Responsible.** All operations connected with the handling of misfired charges shall be performed only under the direct supervision of the blaster.

2. **Mishandling Blasting Machine.** In electrical firing it is important that the blasting machine be operated with force and speed, since the faster the rack bar is pushed down, the more current flows through the circuit at the end of the stroke. Observance of this precaution will prevent many misfires.

3. **Faulty Connection.** When a misfire is located after a blast, a galvanometer shall be used to test the circuit for broken wires or faulty connections. If a short circuit or faulty connection is determined to be the cause of the misfire, proper repairs shall be made, the lead wires reconnected, and the charge fired.

4. **Inserting New Primer.** When an unexploded charge cannot be fired through existing connections, the stemming material shall be removed, a new primer inserted and the charge fired.

5. **Removing Stemming Material.** Where it is necessary to insert a new primer in an unexploded charge confined by a solid stemming material, the stemming material shall be removed only by means of a stiff rubber hose with water under pressure. (For complete information, see "The Blaster's Handbook," published by E. I. DuPont de Nemours and Co., Inc.)

6. **Extracting Explosives Prohibited.** No person shall be permitted to extract explosives from an unfired hole.

7. **Guarding Unfired Charge.** Under no conditions shall unfired charges be left unattended overnight or until the next shift.

8. **Electronic Transmitter Hazard.** Premature firing of electrical blasting circuits can be caused by radio frequency energy. Activity regulations concerning electrical blasting shall take into account the location and characteristics of electronic transmitters both within and outside the confines of the activity. Regulations to minimize this hazard shall comply with precautions described in "The Blaster's Handbook," published by E. I. DuPont de Nemours and Co., Inc.

9. Where the hazard of R-F energy cannot be avoided, blasting shall be done by cap and fuse.

MT-PWHD-005382

0008 1065 REDACTED
J-M 83

CLEARING AND GRADING

0870. GENERAL

1. **Protective Equipment.** Personal protective equipment or apparel of approved type shall be worn by workers for protection against eye, head, leg, or foot injuries, and while working in water or swampy areas and on ice and other hazardous surfaces.

2. **Carrying Cases for Tools.** Sharp-edge tools shall be transported in carrying cases or sheaths.

3. **Machetes.** Machetes shall be kept in sheaths at all times except when in actual use.

4. **Standing Clear.** All hands shall stand as far away as possible from moving machines, equipment, or moving logs and taut lines.

5. **Lighting.** When operations are conducted at night, adequate artificial illumination shall be provided either in the form of headlights or by general lighting of the work area.

0871. FELLING AND TRIMMING TREES

1. **Clearing Underbrush.** All underbrush, vines, small trees, etc., that will interfere with felling operation, shall be cleared before trimming or felling begins.

2. **Dead Limbs and Rotten Hearts.** Before felling, all trees shall be inspected for rotten hearts, dead or entangled limbs, or similar hazardous conditions. Dead or entangling limbs which endanger employees shall be removed.

3. **Skilled Supervisor.** Trees which present an unusual hazard, such as dead, hollow, or leaning trees, or those with multiple growths or rotten heart shall be felled under the direction of a skilled supervisor.

4. **Undercutting Trees and Use of Wedges.** All trees shall be properly undercut before felling, with a deep "V" grooved notch on the side where the tree is to fall. Wedges shall be used to throw all balanced trees.

5. **Warning of Falling Tree.** Persons in the danger areas shall be warned prior to the felling of trees. A loud warning call, "TIMBER" shall be given at the time of the felling of each tree.

6. **Avenues of Escape.** Persons engaged in felling trees should look over the area carefully before starting to fell a tree, and note mentally the existing avenues of escape.

7. **Carrying Unguarded Tools.** Workmen shall never climb trees while carrying unguarded sharp-edged tools.

8. **High Winds.** Working in or on trees during high winds is prohibited, except in an emergency and then only under the supervisor's direct supervision.

9. **Securing Felled Tree.** After felling a tree, the tree must be lying on the ground and adequately chocked or otherwise secured before leaving it or going to the next tree.

10. **Trimming Branches.** Before felled trees are trimmed, they shall be properly secured by chocking or other means to prevent them from rolling.

11. **Use of Chain Saws.** Extreme care shall be exercised when using chain saws to fell trees. Chain saws shall not be used to fell rotten heart or hollow trees.

0872. BURNING

1. **Conducted in Clear.** Burning operations shall be kept under strict control and not left unattended. *They shall always be conducted in the clear,* where the fire will not ignite leaves, dry wooded areas, or nearby buildings. Workmen shall not stand in the smoke. All burning or smoldering material must be *completely extinguished* before workmen leave the scene.

2. **Windward Side.** Firing, punching, and placing of material for burning shall be done from the windward side. This is especially

MT-PWHD-005383

0008 1066 REDACTED J-M 83

important when poison oak, poison sumac, or poison ivy is being burned.

3. **Flammable Liquids.** Workmen shall never use flammable liquids on piles of material which are burning or smoldering.

0873. POISONOUS PLANTS

1. **Scrubbing Skin.** If a workman has been in contact with poison ivy, poison oak, or sumac, the skin should be swabbed with alcohol and scrubbed with laundry soap and water. A brush or a rough cloth should not be used as they might irritate the skin and increase the danger of poisoning.

2. **Protective Clothing.** Heavy gloves and clothing should always be worn when handling poisonous plants. The clothing should be changed daily.

3. **Burning Poisonous Vines.** When burning poisonous vines it is important to keep away from the smoke, which will carry the poison and may be inhaled.

4. **Medical Care.** If infection develops after contact with poisonous plants, a physician should be consulted. Self-medication with poisonous plant immunization or desensitization extracts should never be undertaken. Men who are extremely sensitive to these poisons should be transferred to other jobs.

0874. BULLDOZERS AND TRACTORS

1. **Speed of Operation.** Equipment of this type shall be operated at a speed such that the machine can be kept under control at all times.

2. **Guards.** Bulldozers used in clearing operations shall be equipped with crank-case guards and radiator protection.

3. **Falling Objects.** Care must be exercised when using a bulldozer for demolition work, to prevent falling objects from hitting the operators or personnel assisting in the operation.

4. **Felling Trees.** When felling trees with a bulldozer care must be used to avoid falling branches, kickbacks, etc.

5. **Riding Drawbar.** Workmen shall never ride on the drawbar of a tractor. Many serious accidents have resulted from this dangerous practice.

6. **Location of Operations**

a. **Underground Utilities.** Operators of bulldozers should find out whether there are or may be underground high voltage cables or gas lines in the area.

b. **Operating Close to Cut.** Bulldozers shall not be operated too close to the edge of a cut, since the bank may give way causing the machine to fall into the hole and be overturned.

c. **Inclines.** Operators shall drive up sharp inclines slowly and carefully; "gunning" a bulldozer or tractor up a steep or broken slope may cause overturning.

d. **Turning on Slope.** Operators shall not attempt to turn around on a steep slope. They should back up (or down). Sliding sidewise is not in itself dangerous; it is the sudden stop when the tractor hits a solid rock or stump which creates the real danger of the machine rolling over.

7. **Towing**

a. **Checking Hitch.** The operator shall himself check the hitch before starting a tow; a runaway tow is a serious hazard.

b. **No Substitute for Tow Bar.** Chains, wire lines, and makeshifts shall not be used for towing; a tow bar shall always be used.

c. **Coupling Trailing Equipment.** Coupling up trailing equipment to the tractor is hazardous. The operator shall be sure that the gear shift is in neutral.

d. **Low Gear on Down Grade.** When towing a heavy load down grade, the tractor shall be kept in a low gear. Coasting is dangerous; it may cause the tractor to "jackknife".

e. **Detaching Tractor.** After pulling the pin to detach the tractor from a piece of rolling equipment, the groundman shall move into the clear where he can signal the tractor operator. His position then should be such that he can see both pieces of equipment, all obstructions in the line of travel, and the other workmen.

MT-PWHD-005384

0008 1067

REDACTED
J-M 83

0875. GRADERS

1. Load Limits of Bridge or Ramp. Operators shall never operate heavy equipment of this type over a bridge or ramp until load limits have been checked and the bridge ramp approved for that purpose.

2. Marking with Red Flag. When a blade grader is being operated slowly on a highway or roadway in hilly or rolling country, a red cloth flag shall be displayed on a staff which projects at least 6 feet above the left rear wheel. In such cases the grader shall be kept to the right of the highway.

3. Riding on Grader. Operators shall always ride on the seat or stand on the platform of the grader. They shall never ride on the tandem or on the back of the grader. They shall never permit other persons to ride on the grader in any place except inside the cab or on the platform.

4. Engaging Clutch. Operators shall be sure that the gear shift is in neutral before they start the engine. The clutch should always be engaged gently, especially when going up a hill or pulling out of a ditch.

5. Turning and Braking. Operators shall always reduce speed before making a turn or applying the brakes.

6. Down Grades. The grader shall always be kept in gear when going down steep grades.

7. Holes on a Hillside. Extra care should be taken when working on hillsides, to drive slowly and watch out for holes or ditches into which a wheel may drop and cause the grader to overturn.

8. Pulling Loads. Graders shall not be used to pull stumps or other heavy loads.

9. Warning of Obstructions. There shall be close cooperation between the driver of the towing equipment and the grader operator so as to avoid shocks or jars to the scraper. Drivers should warn the rear operator of holes, rock outcrops, or stumps in time to prevent damage to the machine or possible injury to the operator.

0876. SCRAPERS

1. Speed of Operation. Scrapers shall be operated at speeds consistent with conditions on the particular job.

2. Scraping Shoulder of Road. Scrapers should be driven off the shoulders of roads only at slow speeds. On some machines the sudden dropping of one wheel results in violent tilting, with the possibility of serious injury to the driver caused by his being thrown off the machine or against wheels or levers.

3. Line Attached to Pulling Unit. A scraper shall never be operated without a safety line attached to the pulling unit. Failure of the drawbar can result in a serious accident.

4. Replacing Blades. The scraper bowl should always be blocked up when the blades are being replaced.

5. Platforms Clear of Debris. The operating platforms of scrapers and graders shall be kept free of material and debris, also from grease, oil, or mud.

6. Braking. When going down hill the operator should not kick the machine out of gear, because increased speed may make control of the equipment extremely difficult. He should leave the machine in gear and use his brakes to control the speed. If the brakes will not hold the load, the operator should drop or drag the scraper bowl to make an emergency stop.

7. Directing Traffic. Operators of scraper machines shall not attempt to direct traffic while operating the equipment. A competent signalman should be assigned to direct traffic.

8. Marking Drag. Vehicles drawing a drag shall be marked to indicate the presence of the drag, or a flagman shall be stationed so as to warn other drivers of the danger.

1778

MT-PWHD-005385

REDACTED
J-M 83

0880. GENERAL

1. Regulations. Where they are applicable, federal, state, or local codes, rules, regulations and ordinances governing any and all phases of excavation work shall be observed at all times.

2. Underground Utility Installations. Every effort should be made prior to making an excavation to determine whether utility installations (sanitary and storm sewers; water, gas and electric lines; gasoline tanks; etc.) are to be encountered. When the excavation approaches the estimated level of such an installation, the installation should be located from blueprints, if available, or by careful probing and digging, and when uncovered, it should be properly supported and protected.

3. Removal of Obstacles. Trees, boulders, and other surface encumbrances located so as to create a hazard at any time during operations shall be removed before excavation is started.

4. Shoring Adjoining Walls. If the stability of adjoining buildings or walls is endangered by excavations, necessary shoring, bracing, or underpinning shall be provided to insure their safety. Such shoring, bracing, or underpinning shall be frequently inspected by a competent person and the protection effectively maintained.

5. Bracing Nearby Excavation. If it is necessary to place or operate power shovels, derricks, trucks, material, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.

6. Protecting Masonry Wall. Wherever any side of an excavation is a masonry wall, such wall shall be braced to insure stability. This shall not include reinforced concrete walls known to be of ample strength.

7. Sheet Piling. Temporary sheet piling which has been installed to permit the construction of a retaining wall shall not be removed until such wall has acquired its full strength.

8. Digging Below Foundations or Retaining Walls. Except in hard rock, excavations below the level of the base or footing of any foundation or retaining wall shall not be permitted unless the wall is underpinned and all other precautions taken to insure the stability of the adjacent walls for the protection of the workmen.

9. Undercutting Earth Banks. Undercutting of earth banks shall not be permitted unless they are adequately shored.

10. Inspection After Rainstorm. Excavations shall be inspected after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins increased if necessary.

11. Landing Platforms. All fixed-in-place ladders and stairways giving access to levels 20 or more feet apart shall be provided with landing platforms at vertical intervals of not more than 20 feet. Every landing platform shall be equipped with standard railings and toe boards.

0881. PROTECTION OF THE PUBLIC

1. Walkways and Thoroughfares

a. Guardrails. All public walkways, sidewalks, and thoroughfares bordering on or running through any construction site shall be provided with substantial guardrails or board fences. In addition, temporary footwalks beyond the curb shall be substantially constructed and provided with protection on both sides.

b. Clear of Obstructions. Sidewalks and walkways shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a live load of 125 pounds per square foot.

MT-PWHD-005386

0008 1069 REDACTED J-M 83

c. **Fastening Planks.** If planks are used for a sidewalk they shall be butt ended and cleated underneath to prevent displacement. Planks shall be uniform in thickness and all exposed ends shall be beveled to prevent tripping.

d. **Raised Walkways and Ramps.** Raised walkways shall be provided with plank steps on strong stringers. Ramps used in lieu of steps shall be provided with cleats to ensure safe walking.

2. **Warning Signs and Watchmen.** A flagman or watchman shall be designated to warn the public of the approach of trucks and to direct the trucks in and out of the property. Danger or warning signs shall be posted at all truck entrances and exits.

3. **Illumination.** During the hours of darkness, all public sidewalks and walkways shall be adequately illuminated, and warning lights or flares shall be placed about the property to ensure safety for pedestrians and vehicular traffic.

4. **Overhead Protection.** The public shall not be required or permitted to travel under loads handled by power shovels, derricks, or hoists, unless ample side barricades and overhead protection are provided.

0882. BRACING OF EXCAVATION

1. **Amount of Bracing.** All shoring, bracing, or sheet piling shall be consistent with the magnitude of the work and the character of the soil or material in which the excavation is made.

2. **Protection Against Caving.** If men are working near the face of an excavation, where the ground is cracked or of such character that caving is likely to occur, sheet piling with shoring and bracing necessary to prevent caving shall be provided.

3. **Quality of Timber.** All timber used for shoring, bracing, and sheet piling should be sound straight-grained timber equal to long leaf yellow pine, Douglas fir, or other materials of equal strength. All timber shall be free from splits, shakes, large or loose knots, and shall be of the required dimensions throughout.

4. **Wooden Sheet Piling.** Wooden sheet piling shall be not less than 2 inches in thickness. The thickness shall be increased as required to adequately support the sides of the excavation.

5. **Temporary Bracing.** Where temporary sheet piling is used during excavation work, the shoring and bracing to be provided shall comply with the requirements which follow.

a. **Intervals.** When shores and braces are required they shall be placed at intervals of not more than 8 feet measured parallel with the sheet piling.

b. **Soil Pressure.** Shores or braces shall bear at the earth against a footing of sufficient area to keep within the allowable soil pressure, "dead men" being buried when necessary to resist the thrust of the braces.

c. **Wedges.** Shores or braces at the sheet piling shall not be cut to a bevel but shall be held by wedges and the wedges shall be nailed.

0883. LOADERS

1. **Clear of Chains and Sprockets.** Operators shall stay away from chains and sprockets of the driving mechanisms of all types of loaders, particularly from the loading end.

2. **Guarding Belts and Shafts.** Where practicable, the belts and transmission shafts of loaders shall be guarded.

3. **Electric Motor.** Where an electric motor is used as the motivating force the motor should be completely enclosed, properly grounded, and electric conduit of approved type used to connect the motor to the power supply.

4. **Combustion Engines.** Where a combustion engine is used as the motivating source, transmission lines, gears, shafts, and other moving parts should be completely guarded.

5. **Workmen Clear.** Workmen engaged in the area where loaders are operating shall

1780

MT-PWHD-005387

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REDACTED
J-M 83

take great care to stay well away from the loaders. All the precautions which should be observed by the operators of trucks, graders, pavers, and other power-driven equipment, and by employees who work around such machinery, are directly applicable to loaders.

0884. POWER SHOVELS

1. Inspection and Testing. Power shovels shall be inspected and all motions, brakes, and clutches tested, before starting work.

2. Soft Ground. Extreme care should be exercised when setting the power shovel. Mats or heavy planks should be used on soft ground.

3. Operator Restrictions. No unauthorized person shall be allowed on the operating platform when the shovel is in operation, and the operator shall not converse with anyone while operating the machine.

4. Access to Platform. A suitable ladder, or steps and handholds, shall be provided on power shovels to afford safe and easy access to the operating platforms; these devices shall be maintained in good condition.

5. Removing Shovel for Repairs. In case of a breakdown, the shovel should be moved well away from the foot of a slope before repairs are undertaken.

6. Range of Swing. All persons *must* keep away from the range of the shovel's swing, to avoid being struck by the cab as it rotates. When workmen are required to do some particular work at the rear of the cab of a shovel, they should notify the operator that they are working there.

7. Replacing Wire Cables. The wire rope cables on power shovels shall be regularly inspected and shall be changed when 10 percent of the wires in any 3 feet of length are broken.

8. Leaving Cab. Shovel operators shall not leave the cab while the master clutch is engaged.

9. Leaving Bucket on Ground. All shovels when not in use shall be left with the bucket on the ground.

10. Clearing Overhead Wires. Whenever it is necessary to move the shovel under electric wires, there shall be a clearance of at least 10 feet. All necessary precautions shall be taken to prevent contact with the wires.

11. Grounding. Power shovels should be effectively grounded and otherwise protected against the hazards of static electricity.

12. Ramps. Ramps to be used by power shovels should not be made too steep. The brakes and travel mechanisms should be checked before traversing ramps.

13. Slides. When excavating in a bank of sand, gravel, or rocks which has been dynamited, shovel operators must be very careful not to cause a slide by digging the shovel too far into the bank or making cuts too deep.

14. Shovel as Refuge. When blasting, the shovel shall not be used as a safety refuge.

15. Leaving Cab While Loading. Drivers shall not remain in the seat or cab of a dump truck which is being loaded by a power shovel, a clam shovel, drag line, or other overhead means, even if the truck top is equipped with a steel protective shield. They shall always set the brakes, leave the cab, and remain outside the reach of the swing of the bucket until the truck has been loaded.

16. Equipped as Cranes. Precautions for power shovels equipped as cranes will be found in articles 0825-0830.

0885. JACKS

1. Size. Workmen should always select the proper size of jack for the load to be lifted. A jack of too light capacity can strip itself, releasing the load; and a jack with too little height will run itself out before accomplishing the purpose intended.

2. Inspection. The jack should be inspected before using. If there is any doubt

MT-PWHD-005388

0008 167
REDACTED
J-M 83

about the jack's condition, it should not be used.

3. **Footing.** The jack should be placed on a firm footing where it cannot slip or kick away.

4. **Blocking or Cribbing.** When the object has been lifted to the desired height, blocking or cribbing shall be immediately placed under it.

0886. RAMPS AND RUNWAYS

1. **Dimensions.** Ramps or runways used for vehicles shall have a width of not less than 12 feet. Timber guards not less than 8 inches by 8 inches shall be securely fastened on top of the runway along each of the outside edges.

2. **Railings.** Ramps or runways, when used as passageways for workmen, shall be provided with standard railings.

3. **Ruts and Holes.** All ramps and runways shall be maintained in a safe and serviceable condition. When ramps and runways are formed on hard ground without the use of planking, ruts and holes greater than 2 inches deep shall not be permitted.

4. **Blocking Stalled Trucks.** When the pitch of the ramp requires it, a man shall be alongside a loaded truck with a chock provided with a strong handle for blocking a rear wheel if the truck is stalled or otherwise forced to stop on the ramp.

5. **Keeping off Ramps.** Workmen, other than chockers, shall be instructed to stay off ramps and runways when trucks are passing over them.

6. **Foot Cleats.** Where the incline of the ramp is too steep for safe walking, foot cleats, not more than 16 inches apart, shall be provided to prevent slipping.

0887. TRENCHES

1. **Shoring.** Particular attention should be given to shoring of trenches, especially if there are roadways or railroad lines in the vicinity of the excavation or if men are to work in the trench. In the following paragraphs, provisions for shoring and bracing of excavations shall apply, except when the full depth of the excavation is in stable solid rock, hard slag, or hard shale or the shoring plan has been designed by a qualified engineer.

2. **Depth and Drainage.** The sides of excavations 4 feet or more in depth, or in which the soil is so unstable that it is not considered safe at greater depths, should be supported by substantial and adequate sheeting, sheet piling, bracing, shoring, etc., or the sides sloped to the angle of repose. Surface areas adjacent to the sides should be well drained. Trenches in partly saturated, filled, or unstable soils, shall be suitably braced.

3. **Storing Material Nearby.** Excavated or other material shall not be stored nearer than 2 feet from the edge of a trench. In the case of extremely deep trenches, material should be stored farther away than 2 feet. The safe storage distance is in proportion to the depth of the trench; the deeper the trench the farther away the material should be stored.

4. **Hazards to Traffic.** Where pedestrian and vehicular traffic is to be maintained over, or adjacent to excavations, proper safeguards should be provided, such as walkways, bridges, guardrails, barricades, warning flags, or lights.

5. **Close to a Cut.** Where an excavation is close to a cut, particularly when nearer to the cut than its depth, special shoring should be used. Men working in deep trenches shall wear hard hats as a protection against falling material.

6. **Ramps, Ladders, and Hoists.** Access to excavations over 5 feet deep should be by ramps, ladders, stairways, or hoists. Workmen should not jump into the trench. They shall not use the bracing as a stairway.

7. **Debris.** No tools, materials, or debris should be left on walkways, ramps, struts, or near the edge of an excavation. Such material might be knocked off or cause a worker to lose his footing.

MT-PWHD-005389

REDACTED
J-M 83

8. **Distance between Workers.** Pick-and-shovel men working in trenches shall keep a sufficient distance apart so they cannot injure each other.

9. **Gas or Oil Hazards.** Extra care should be used in excavating around gas mains, oil tanks, gasoline or oil pipe lines, etc. Smoking or open fires of any kind are prohibited in areas where gaseous conditions are suspected. In such places the air should be tested and, if gas is present, ventilation should be provided by portable blowers or other satisfactory methods.

10. **Barricades and Lights.** Workmen shall put up barricades and lights around the excavation at the end of each work shift for the safety of personnel moving in that area after dark.

0888. DITCHING MACHINES

1. **Clear of Debris.** The runways, steps, and handholds of ditching machines shall be kept clear of waste oil, grease and loose tools in order to minimize the possibility of slipping or falling.

2. **Care When Starting.** Extreme caution shall be used at all times around the machine while the engine is running. Before starting the machinery, care shall be taken to see that all persons are at a safe distance from the moving parts.

3. **Attending Machine When in Operation.** Operators of ditching machines shall never leave the operator's position while the machine is in operation, or attempt to remove objects from the conveyor while it is in operation.

4. **Clearing Buckets.** When clearing the buckets of large rocks, sticks, and roots, workmen out in front of these machines should be afforded a handhold of some kind on the machine. These workers are in danger of falling against moving parts or dropping on to the bucket wheel or chain should the banks cave in. A railing should be placed around the bucket chain on those ditchers which are suited to such action.

5. **Standing On or Near Ditchers.** Workmen shall never stand on the ditching machine, or between the machine and high banks of soft material where there is danger of a cave-in. When working around a ditcher, they should always be sure that the gear driving that unit is in neutral position.

6. **Parallel to High Bank.** When excavating in a direction parallel to high banks, ditching machine operators shall exercise caution to prevent loose material and objects from becoming dislodged and falling down on workmen below.

7. **Leaving Buckets in Ground.** Ditcher buckets shall not be left in the ground when not operating. The sides of the ditch can cave in and injure personnel.

8. **Lighting and Flagging.** Trenching machines and their operations shall be well flagged by day and adequately equipped with lights when used at night.

9. **Pushing Displaced Dirt.** Long handled shovels shall be utilized by workmen engaged in pushing displaced dirt out of the path of the trenching machine buckets.

0889. PNEUMATIC PAVING BREAKERS AND ROCK DRILLS

1. **Goggles.** Suitable goggles shall be worn when operating these machines to protect the eyes from flying particles.

2. **Paving Breaker.** Operators must make sure that the breaker and its accessories are in good working condition.

3. **Valves and Trigger.** When air is used for power, the valves and connections shall be checked carefully. Also, when laying down these pneumatic tools, the operator must be careful to see that the trigger cannot be operated accidentally.

4. **Untempered Tools.** When shock tools are re-dressed the heads shall not be tempered, since hard heads will spall and are more dangerous than those which mushroom.

5. **Kinking Hose.** Pneumatic paving breaker operators shall never cut off the air

MT-PWHD-005390

0008 1073 REDACTED
J-M 83

supply to the machine by purposely kinking the hose while disconnecting this equipment. Air shall be cut off at the source.

6. **Barriers.** If the job is near a sidewalk or other thoroughfare, canvas barriers or other suitable screens shall be placed on either side to protect passers-by from flying particles.

7. **Roughing Concrete Surfaces.** When using a paving breaker to break up extremely hard materials such as heavy blocks imbedded in concrete slabs or with hard and slick surfaces that may cause the tool to slip around instead of biting into the surface, workmen should first use a sledge hammer to roughen the surface. This practice will guard against breaking or cutting the legs or feet.

0890. PILE DRIVING

1. **Crew.** Each member of a pile-driving crew shall be carefully chosen and shall be experienced or instructed in detail in the work he is to do.

2. **Signals.** Engineers and winchmen shall not accept signals from anyone but a supervisor or other person especially appointed to give signals. The code of signals used shall be posted in an easily visible place.

3. **Steam Condensation.** Engineers shall not blow condensation from a steam-driven apparatus while employees are in a nearby exposed position.

4. **Protective Apparel.** All men handling piles shall wear heavy gloves, safety shoes, and protective hats. Shin and foot guards shall always be worn when heading or pointing piles with axes.

5. **Protection from Creosote Spray.** When working with creosoted material workmen shall put on goggles and apply a protective cream or lotion to all exposed parts of the body to protect their eyes and skin from creosote spray.

6. **Pile Driving in Water.** Where pile driving is done in water from a trestle or from a floating rig, men shall be provided with kapok life vests or jackets or the equivalent. Each rig shall be equipped with life preservers and life lines for emergency use.

7. **Hammer and Driving Heads.** When a pile driver is not in use the hammer shall be held in place at the bottom of the leads by a cleat or timber. Driving heads shall be tied in whenever the rig is being used to shift cribbing or other material.

8. **Grabline.** The grabline shall be in place at all times.

9. **Making Repairs.** Repairs shall never be made to any steam or air equipment while it is in operation or under pressure.

10. **Defective Air Hose.** When compressed air equipment is used, defective air hose shall be promptly replaced. Inspections should be made frequently to locate defects.

11. **Platform Clear of Debris.** The main working platform on the pile driver shall be kept clear of lumber, ropes, and tools.

12. **Overhead Wires.** Care must be exercised to see that the high parts of the pile driver do not come in contact with overhead electric power lines when the equipment is moved.

13. **Drums, Brakes, and Leads.** Hoisting drums and brakes shall be kept in the best of condition and sheltered from the weather. Leads shall be kept well greased to provide for perfectly smooth travel of the hammer.

14. **Danger from Hammer.** A workman shall never place his head or other part of his body under a suspended hammer that is not dogged or blocked in the leads.

15. **Cutting and Burning.** When steel piling or other metal is being cut by burning, the operator shall wear goggles or a helmet designed to protect the eyes against harmful rays.

0891. WELL DRILLING

Precautions for well drilling and earth boring equipment are similar to those listed above for pile driving.

MT-PWHD-005391

0008 1074
REDACTED
J-M 83

0892. DREDGING

1. Deck Areas Clear. Good housekeeping shall always be observed on operating dredges. Deck work areas, ladders, catwalks, and passageways shall be kept clear of trash and loose material. Deck fittings and similar hazards should be painted No. 14 Brilliant Yellow (see NAVDOCKS P-309).

2. Lights and Fog Horns. Dredges operating in navigable waters must be lighted and meet all other navigational requirements. In foggy weather, horns or bells must be used to warn all watercraft of the proximity of the dredge to traffic.

3. Overhead Power Lines. Workmen on dredges shall never under any circumstances throw ropes or tapes over an electric power line under which the dredge must pass. Such lines may become wet through handling, resulting in a serious electrical burn or fatality.

4. Floating Pipe Lines. Walkways on floating pipe lines shall be provided with suitable handrails and kept in good condition. Floating lines must also be properly lighted to meet navigational requirements.

5. Personnel Protection

a. Life Preservers and Lines. Dredges and floating lines shall always be equipped with life preservers and life lines for use in emergencies.

b. Safety Vests. Deck hands working on dredges or in small boats shall wear an approved type of life vest or jacket all the time they are on duty. If the vest becomes wet personnel should change to a dry one as soon as practicable.

6. Special Handling Equipment. When engaged in major repair operations such as dismantling the dredge pump to remove large boulders or tree trunks, removing cutters, or repairing pipe lines or shafting on the dredging ladders, workmen on dredges must use the special handling equipment provided and should exercise extreme caution in handling these heavy parts so as to prevent injury and drowning.

7. Using Small Boats. When approaching the dredge or floating pipe line in a small boat, the approach shall always be made heading into the tide. The boat shall be securely fastened to the dredge or pipe line before any worker leaves it; the oars shall be removed from the locks and placed in the bottom of the boat while not in use.

1785

MT-PWHD-005392

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J-M 83



CHAPTER 9





1786

0008 1076

REDACTED
J-M 83

Chapter 9
METAL WORKING

THE MACHINE SHOP

0901. SCOPE

The safe practices described in this chapter are applicable to all types of power-driven tools and should be used by all machine operators to avoid accidents involving themselves and other personnel. If there is any doubt about a safe procedure, the supervisor shall be consulted.

0902. HOUSEKEEPING

1. Areas around machines should be kept clear of obstructions and in nonslippery condition. All spilled oil or grease shall be cleaned up immediately.
2. Employees must keep their machines clean.
3. Do not clean chips from the surface of machines with compressed air or with hands; a brush or hook should be used. Where general cleaning of machines and equipment by compressed air is considered necessary, the outlet pressure shall be reduced to not more than 10 p.s.i. by means of a regulator or pressure reducing control nozzle designed for this purpose.
4. Cleaning of one's clothes with compressed air is prohibited.
5. When using portable electrical equipment around machine tools, keep all electrical cords clear of moving parts.
6. Do not place hand tools on lathes or other machines. Keep them in their assigned location. There are certain areas on some lathes and machines which are useful for laying hand tools, as well as wooden platforms especially built to fit across the way of the lathes, which may be used for hand tools.

0903. PROTECTIVE CLOTHING

1. Loose, flowing, or torn clothing, gloves, neckties, long sleeves, and rings or bracelets shall not be worn around machinery. Snug-fitting clothing shall be worn.
2. Goggles or face shields shall be worn when grinding or when there is danger of flying particles.
3. Gloves are *not* to be worn around rotating machinery unless sharp or rough materials are being handled. If gloves are worn because of sharp material, great care should be exercised to prevent their being caught in the machinery.
4. If clothing becomes caught in a machine, the power shall be shut off immediately.

0904. MACHINE GUARDS

1. All guards on saws, drill presses, and machines are to be properly adjusted and in working order before starting the machine.
2. All gear and belt guards must be in place before machine is operated.
3. Machine guards must be kept in position at all times unless removal is authorized for repairs or cleaning.

0905. PRELIMINARY PRECAUTIONS

1. No employee shall be permitted to operate a machine with which he is unfamiliar.
2. Be sure all is clear before starting any machine.
3. Do not start a band saw or saw of any type without first determining that the blade is in good condition and operating freely.
4. Unless conditions make it impractical, no employee should be permitted to operate electric or mechanical equipment or machines in a building or room when alone.
5. Before operating a machine make sure there is plenty of light to work by.
6. See that tools and work are properly clamped before starting the machine.

1787

MT-PWHD-005394

0008 1077

REDACTED J-H 83

7. Switch and clutch of power equipment shall be located so that operator can control power without reaching across work.

0906. REPAIRING MACHINERY

1. All needed repairs shall be reported. Repairs, unless otherwise authorized by the supervisor, are to be made only by a repair mechanic.

2. Do not repair, oil, or clean machinery while it is in motion. Lubrication while machinery is in motion shall be done by remote control lubricating system.

3. Shut off the power to machines during repairs or adjustment and attach a warning card to the switch. Lock switch with a padlock to insure that the machine will not be energized by other personnel.

4. Switches and valves, movement of which will endanger personnel working on lines and machinery, shall first be locked by the man in charge of the work before permitting work thereon.

5. The power shall be shut off when changing such machine parts as face plates or chucks on lathes.

6. Block up ram and cut switches on power hammers, punches, and presses when it becomes necessary to place any part of the body underneath it.

7. Replace machine guards after repairing, oiling or greasing, or after inspections have been completed and before the machine is started.

8. All tools used in making repairs or adjustments shall be removed so that all working parts of the machine will be free to move without damage. Care shall be taken that no one is in a position to be injured when the machine is again set in motion.

0907. OPERATING PRECAUTIONS

1. Do not attempt to adjust a tool or feel of the cutting edge while the machine is in motion.

2. Moving belts shall not be shifted except with a belt pole or suitable stick. Do not use hands or feet to shift belts.

3. Never apply a wrench to revolving work or parts.

4. Do not use steel hammers to knock cutters into position.

5. Do not use hands or body to stop moving parts, even when the power is shut off.

6. Never lean against a machine that is running.

7. Never leave moving machinery unattended.

8. Do not distract the attention of a machine operator.

9. Excessive cutting speeds, feeds, and depth of cut should be avoided.

10. Cutting tools shall be removed from machines when not in use.

0908. WIRING

1. **Insulation.** Do not use electrical equipment or machines with frayed or otherwise deteriorated insulation.

2. **Grounding.** Electrically driven portable machinery as well as fixed electrical equipment shall have the frame grounded (see article 1512).

MACHINE TOOLS

0915. LATHES

1. **Dangers.** The principal sources of injury to lathe operators are: projections on face plates and chucks; projecting set screws in lathe dogs; projections on the work; chips; cutting fluid; handling heavy chucks or stock; and rotating stock projecting from turret lathes and automatic screw machines.

2. **Shields and Guards.** Face plates and chucks should have no projections; or circular shields should be installed to prevent accidental contact with projections. Safety type lathe dogs, with no projecting set

1788

MT-PWHD-005395

REDACTED
J-M 83

screws should be used. Chip guards, particularly on high speed operations, are recommended. Splash guards should be provided to protect the operator and the working area from cutting or cooling fluids thrown from the work. Pipe guards or other enclosures should be installed to prevent injury from stock projecting from turret lathes or automatic screw machines.

3. **Protruding Tail Stock.** Completely cover all tail stock protruding from the end of a machine lathe when the machine is in operation.

4. **Filing.** When filing close to chuck or dog, always file left-handed. Never use a file with an unprotected tang; use a file handle.

5. **Installing Chucks.** Chucks or face plates on lathes shall be installed by hand power only. The power which drives the machine shall never be used for this purpose.

6. **Handling Chucks.** Mechanical lifting devices should be provided for handling heavy chucks.

0916. MILLING MACHINES

1. **Dangers.** The chief hazards of the milling machine are created by the rotating cutter and flying chips.

2. **Guards.** A transparent shield over the cutter will prevent accidental contact with the cutter and serve also as a chip guard. Guards may be adjustable.

3. **Control Buttons.** Control buttons and levers should be readily accessible to the operator. Hands shall be kept away from work when machine is running.

4. **Clamping Work.** The cutter and arbor shall be secure. The work shall be clamped securely before the machine is started.

0917. SHAPERS AND PLANERS

1. **Railings.** To minimize the hazard created by the movement of the carriage or table, railings extending beyond the farthest point of travel should be installed.

2. **Wire Guard.** Where practicable, a readily detachable chip guard of heavy wire mesh should be placed over the cutting tools.

3. **Openings in Planer Bed.** All openings in shaper and planer beds should be filled solidly or completely covered.

4. **Goggles.** The operator shall wear goggles and stand out of the line of flying chips.

5. **Loosening Tool Holders.** When tool holders are being loosened, the tool shall be held with one hand or a support placed under it.

6. **Adjusting Bed Stroke.** The planer shall be idle when the length of the bed stroke is being adjusted. No one shall ride the bed at any time. Tools of any kind shall not be left under the bed.

7. **Removing Chips.** A brush—never hands—shall be used to remove chips; chips shall be kept off the ways, floor, and bed of planer.

0918. DRILL PRESSES

1. **Dangers.** Most drill press injuries result from projection on the spindle, insecurely clamped work, accidental contact with the drill, or the breaking of the drill.

2. **Enclosing Spindle.** The spindle should be enclosed as completely as possible, and where the job will permit, a telescope guard placed over the drill is advisable. Counterweight chains should be maintained in good condition.

3. **The Drill.** Only straight, undamaged drills, properly sharpened to cut to the right size shall be used.

4. **The Chuck.** The chuck shall be tightened securely with the key provided. The key shall not be left in the chuck. Common wrenches or pliers shall not be used on any chuck.

5. **Clamping Work.** The work shall be firmly clamped and a center punch used to score the material before the drilling operation is started. If the work should slip from

MT-PWHD-005396

REDACTED
J-M 83

the clamp, no attempt shall be made to stop it with the hands. The machine shall be stopped while making any adjustments or repairs.

6. **Personnel Protection**

a. Snug-fitting clothing shall be worn.

b. A cap shall be worn if the operator's hair is long.

c. Gloves shall not be worn while the drill is in operation. If rough material is being worked on, gloves may be used but only while handling material.

d. No one shall reach around a revolving drill.

e. Hands shall never be put under the ram.

f. No one shall pull tripping rods or tamper with safety devices.

7. **Special Tools.** Attachments and special tools provided for the feeding or removal of parts shall be used.

0919. BORING MILLS

The revolving table of a vertical mill should be protected by a sheet metal or pipe-rail guard. The guard should be hinged to permit convenient access for the setting up and adjustment of the job. Work should be securely clamped to the table and no measurement or adjustment should be attempted while the machine is in motion.

0920. METAL SAWS–GENERAL

1. **Protection of Personnel**

a. **Authorized Personnel.** Only authorized employees who are qualified to do so shall operate saws.

b. **Face.** Goggles or face shields shall be worn while using the power saw and while cleaning up afterward.

c. **Hands.** When thick material is to be sawed, the hands shall be placed to the side and to the rear of the material, out of line of travel of the saw.

d. **Reaching.** No one shall reach over a saw to get finished material.

2. **Inspection of Blade.** The blade shall be inspected at frequent intervals and always after it has locked, pinched, or burned. The power shall be shut off and steps taken to ensure its not being turned on again until necessary repairs or adjustments have been made.

3. **Small Pieces.** In machining small pieces, a stick with a notch cut in it shall be used to push the pieces through the saw.

4. **Long Material.** When long material is to be sawed, the end shall be supported by a rack, table, or by a fellow employee.

5. **Overloading Motor.** The saw motor shall not be overloaded by pushing too hard or cutting stock that is too heavy.

0921. CIRCULAR SAWS

1. **Hood.** Circular saws should be equipped with a hood guard which automatically adjusts itself to the thickness of the stock being cut. When tube or bar stock is being cut, the sliding stock guide should be used

2. **Disposal of Scrap.** The part of the saw under the table should be guarded with a complete enclosure which provides for the disposal of scrap metal.

3. **Saw Tables.** Saw tables shall be firmly secured to the deck or floor.

4. **Flying Particles.** A transparent guard placed in front of and over the saw will provide protection against flying particles of metal.

5. **Exposed Blade.** The segment of blade exposed at any time should not be more than 3/8 inch greater than the thickness of the stock being cut.

0922. BAND SAWS

1. **Enclosed Wheels.** The band saw shall have upper and lower wheels completely enclosed with sheet metal or heavy small-mesh screen. The portion of the saw blade between the upper saw guide and the upper saw blade wheel shall be completely enclosed with a sliding fixture attached to the guide.

2. **Access Doors.** Access doors equipped with latches should be provided for changing blades.

1790

MT-PWHD-005397

0008 REDACTED J-M 83

3. Crowding. Do not crowd or twist a band saw or stand immediately in front of the cut.

4. Brazed Joints. To avoid vibration, brazed or welded joints shall be the same thickness as the saw blades.

0923. SHEET METAL WORK

1. Squaring Shears. When shears are located in congested areas it may be advisable to erect railings on the exposed sides and at the rear of the machine. Treadles on squaring shears shall be guarded throughout their entire length by fixed guards which leave only sufficient room between guard and treadle for the operator's foot. When shears are equipped with extended back-gages (motor operated) a large convex mirror can be mounted in such a manner as to give the operator a full view of the back of the shears and under the back-gage bar.

2. Alligator Shears. Where practicable the moving jaw of an alligator shear shall be enclosed in a heavy mesh guard. The guard can be adjustable for different thicknesses of material. In addition and where practicable, a barrier guard shall be installed in front of the knife. The lower edge of the guard should be low enough to prevent placing the fingers under the knife. A hold-down bar should be provided for use with heavy stock. In crowded areas guard rails should be installed.

3. Beaders. Large sheets of metal shall be supported while being beaded.

4. Hand Brakes and Hand Shears

a. The metal to be shaped and the hand brake shall be cleaned thoroughly before the operation is started.

b. When beating out the bend in the material, care shall be taken that the hammer does not glance off and cause injury.

c. Care shall be taken while using the shears that the hand is not jammed or pinched.

d. Large sheets of metal shall be supported while being worked on.

e. Rough edges and burrs left on the materials after cutting shall be removed.

0924. RUBBER MAKING MACHINERY

Rolls which require a feed opening large enough to admit large masses of rubber cannot be guarded with a barrier with an opening small enough to keep the hands out. Therefore, the inrunning side of the calendar rolls shall be equipped with horizontal safety trip rods or cables across the front and back faces of the rolls, and vertical tight wire cables near each end of the front and back faces of the rolls. Such safety stops shall be located so that contacts with the body or head of the operator will instantly actuate the stopping mechanism and quickly stop the rolls.

0925. FORMING ROLLS

1. Guard. A barrier guard should be placed in front of the intake to give protection against operators being drawn into the forming rolls.

2. Clearance. When operating conditions permit, the distance between the guard and the nip point should not be more than three-eighths of an inch.

0926. BUFFERS AND ABRASIVE GRINDING WHEELS–GENERAL

1. Inspection. The ring test shall be made on grinding wheels to ensure they are not cracked. Wheels that are chipped, grooved, or worn out of round shall be dressed or replaced prior to using. Fabric buffers that are frayed, pitted, or worn out of round shall be discarded. Wire buffers that are badly worn, frayed, or loosened at the hub shall be discarded.

2. Personnel Protection

a. Shielding Face. A shatterproof shield preferably of the illuminating type shall be kept in place between the eyes and the work at all times while buffing or grinding. Goggles or face shields shall be worn by the operator.

b. Standing Aside. The operator shall stand to one side of the wheel when first applying power.

c. Protection of Hands. Care shall be taken that the hands are not drawn into contact with the buffing and grinding wheels.

MT-PWHD-005398

0008 1081 REDACTED J-M 83

d. End Guards. All grinders shall be equipped with end guards.

3. Machine Specifications and Use

a. Guards. A guard shall always be used on buffing and grinding wheels.

b. Cleaning. The bearing surfaces of the wheels, flanges, and spindle shall be cleaned so that the clamping pressure will be evenly distributed.

c. Size of Bushing. The hole in the buffer or grinding wheel shall be the proper size for the spindle (neither too small nor too large).

d. Speed. The speed of the spindle shall not run beyond rated speed for the type and size of the buffer or grinding wheel used, nor in excess of manufacturer's specifications.

e. Flanges. Flanges that are recessed and large enough to clamp the wheel well out toward its perimeter shall be used.

f. Washers. Compression washers as large as the flanges shall be used between the flanges and the buffer or grinder. If rubber, use washers 0.125 inch thick; if blotting paper, 0.025 inch thick.

g. Tightening Nuts. Spindle and nuts shall be tightened just enough to keep the buffer or grinding wheel from moving out of position between the flanges.

h. Aligning Buffer. Before the power is turned on, a check shall be made to ascertain that the buffer or wheel runs true and will not strike or rub against any object.

i. Beference. For more details on the care and use of abrasive wheels, see American Standards Association Safety Code, B 7.1.

0927. OPERATING GRINDING WHEELS

1. Position of Hood. Every grinding wheel shall be enclosed in a hood. Tool or work rests shall be mounted on firm supports and be spaced not more than one-eighth of an inch from the surface of the wheel.

2. Clearance. The hood shall be constructed so its periphery can be adjusted to the constantly decreasing diameter of the wheel by means of an adjustable tongue or equivalent. The distance between the wheel periphery and the tongue or end of the periphery band shall be maintained at approximately one-eighth of an inch.

3. Angle of Hood. The upper point of opening in the retaining hood facing the operator shall not be less than 25° nor more than 65° from a vertical line drawn through the spindle center.

4. Swing Frame Machines. The maximum exposure of the wheel periphery or circumference for retaining hood on swing frame grinding machines shall not exceed 180° and the top half of the wheel shall be protected at all times.

5. Stationary Wheels. The maximum exposure of the wheel periphery or circumference on bench or floor stands shall not exceed 90°.

6. Guards

a. Properly Adjusted. Stationary grinding wheels are never to be operated unless protective guards are in their place and the tool rest is correctly adjusted.

b. Replacing with Screen. Portable pneumatic or electric grinding machines using wheels and wire brushes should never be operated without a guard unless shape of job necessitates removal of guard. In this case suitable screens are to be placed around entire job and operators are to wear full protective equipment.

7. Good Condition. Do not use a grinding wheel with a glazed or dull surface or one that is out of balance.

0928. POWER (PUNCH) PRESSES

1. Dangers. The principal source of injuries occurs at the point of operation in the area between the upper and lower dies during such operations as shearing, punching, and forming.

2. Guards. A fixed barrier guard or gate guard at the point of operation shall be provided. If such guards cannot be used, a device which either prevents normal operation of the press until the hands are removed from the point of operation or itself removes the

1792

MT-PWHD-005399

0008 1082

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1973

REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 0926

Subj: Abrasive, Wire, or Buffing Wheels and Sanding Discs

Ref: (a) NAVMAT P-5100,Articles 0926 and 0927

1. GENERAL. The use of abrasive, wire, or buffing wheels and sanding discs is dangerous, and particular precautions must be taken in conjunction with their use. Most accidents result from improper use, abuse, using defective equipment, or using equipment for other than its designed purpose. Most injuries occur as a result of failure to use proper safeguards and personal protective equipment.

2. PEDESTAL MOUNTED EQUIPMENT

a. Shop 06 has prime responsibility for the procurement, storage, mounting, dressing and maintenance of both abrasive and wire wheels which are pedestal mounted, with the following exceptions:

(1) Shop 31 precision grinding. The abrasive wheels used in the precision grinding section of Shop 31 will be mounted, dressed and maintained by personnel of this shop designated by the Group Superintendent.

(2) Shop 51 buffing wheels. The buffing wheels used in the buffing and polishing section of Shop 51 will be mounted and operated only by personnel of this shop designated by the Group Superintendent.

(3) Abrasive cut-off wheels. The mounting and operational care of abrasive cut-off wheels will be the responsibility of the shop in which used.

3. PORTABLE GRINDERS. Portable grinders with operating speeds in excess of 6,000 rpm will be issued by Shop 06 only upon specific authorization for special application such as high speed burring operations. In no case will the operating speed exceed the maximum permissible speed of the wheel, mounted point or burr, as specified by the manufacturer.

4. SAFETY REQUIREMENTS

a. Approved eye protection will be used in all grinding, sanding, wire brushing, burring and buffing operations. The use of face shields in addition to goggles is recommended.

b. Safety guards are required to be in place and used on all applications except the operation of disc sanding. The guarding of disc sanders, though not mandatory, is highly recommended.

1793

0008 1083
REDACTED
J-M 83

c. Wire wheels shall be replaced when the diameters are reduced to 50% of the original.

d. Care will be used in mounting and handling abrasive discs to insure that they are not fractured or otherwise damaged. A daily inspection by personnel of the responsible shop will be made of abrasive wheels in service. This shall include appropriate dressing of abrasive surfaces, repair and adjustment of quards and tool rest, if necessary.

REDACTED
J-M 83

hands from the point of operation shall be used.

3. **Controls.** Control buttons shall be readily accessible to the operator. They shall be located or guarded so that the press cannot be accidentally started.

FOUNDRIES

0935. HEALTH REQUIREMENTS

1. **New Employees.** New employees should be given a thorough physical examination before starting on a job. Any deficiencies noted should be called to the attention of the supervisor so that suitable work assignments can be made.

2. **Examinations.** All employees engaged in foundry work shall be periodically examined in accordance with regulations in NCPI 792.11-1.

0936. HOUSEKEEPING

1. **Aisles.** Provide adequate aisles and keep them clear.

2. **Safe Piles.** Material shall be placed in safe piles in the scrap yard and shop, in order to reduce the possibility of lifting injuries.

0937. SCRAP YARDS

1. **Personal Protective Equipment.** Workers in scrap yards shall be provided with the following protective equipment:

a. safety spectacles equipped with side shields;

b. serviceable type safety shoes or metal foot guards or toe clips;

c. leather gloves, preferably with steel studs;

d. protective hats;

e. foul weather gear;

f. safety belts and lifelines for use inside gondola cars to prevent falling through when hopper doors are opened.

2. **Operating Precautions**

a. Hooking Material. Workers shall be advised on proper method of lifting and hooking up of material.

b. Authorized Personnel. Only authorized and designated men shall operate a crane.

c. Hand Signals. Personnel shall be advised as to the standard hand signals for crane operation.

d. Safety Tools. Safety wrenches shall be used for opening hopper doors. Safety car movers shall be used instead of pinch bars.

e. Loose Material. Piles of sand, clay, or other loose material shall not be undermined.

f. Portable Belt Conveyors. Operators of portable belt conveyors shall be given full instructions. Other employees shall not be permitted to operate such equipment.

g. Suspended Loads. Employees shall not stand under suspended loads. Magnet cranes are especially dangerous. In no case shall cranemen carry suspended loads over employees.

0938. SAND MILLS, CUTTERS, AND SIFTERS (SCREENS)

1. **Safety Apparel.** Operators shall wear safety spectacles with side shields, safety shoes, and close fitting work clothes.

2. **Inspection.** Persons in charge shall see that all moving or revolving parts and projecting set screws on machines are guarded; that the machine is electrically grounded; and interlocking devices are in proper working condition.

3. **Tagging Switches.** Repairmen shall tag and lock all switches before starting any repairs on machines.

4. **Sand Samples.** A sheet metal cone attached to a stick shall be used at all times for taking sand samples.

1795

MT-PWHD-005402

REDACTED
J-M 83

5. **Shoveling Sand.** Sand shall not be shoveled out of mills while they are running.

0939. MOLDING AND CORE MAKING

1. **Safety Shoes.** Congress-type safety shoes shall be worn by all personnel.

2. **Protection of Hands and Feet.** Keep feet and hands from under flasks and core boxes.

3. **Screening Sand.** Sand shall be properly screened or magnetically separated to remove nails and other sharp metal.

4. **Gagger Rods and Tools.** Molders and core makers must work with care in handling gagger rods and core wire. Hand tools used for this purpose must be kept in good condition. Each molder shall have a box in which to keep gagger irons, nails, and clamps.

5. **Bracing Cores.** Careful bracing of cores is necessary in large molds as heavy cores may topple over.

6. **Suspended Molds.** Work must never be done underneath molds that are suspended from cranes. Molds must be placed on tripod supports or substantial horses.

7. **Venting Molds.** Molds shall be carefully vented and rammed to prevent explosions.

8. **Lighting Oil Burners.** In lighting oil burners of annealing furnaces and core ovens, the following rules shall be observed:

a. Make sure air or steam valve is closed.
b. Apply lighted torch at fuel inlet.
c. Open oil valve slightly.
d. Turn on air or steam.

9. **Lighting Gas Burners.** In lighting gas burners of annealing furances and core ovens, the following rules shall be observed:

a. Be sure doors are open wide.
b. Make sure all gas is shut off from furnace and that draft damper is open.
c. Apply lighted torch at gas inlet.
d. Turn on gas.

10. **Floors and Aisles.** Employees must know the importance of keeping molding floor clean, and must see that adequate gangways and aisle space are provided to permit access to molds by those carrying ladles.

11. **Spattering.** Sand shall be poured on concrete pavements around pouring floors to reduce spattering of hot metal in case of a spill.

12. **Water on Floor.** Pools of water must not be left on pouring floor. Molten metal will spatter widely if dropped in water.

13. **Cleaning Molds.** Eye protection must be worn when using air in cleaning off molds.

0940. CUPOLAS AND FURNACES

1. **Back Draft.** Gas masks shall be available near the charging area of cupolas in case of high winds creating a back draft.

2. **Personal Protection.** When necessary to work inside a cupola, a circular screen must be suspended inside the cupola to protect the men from falling objects. Protective hats, safety shoes, and goggles shall be worn for this work.

3. **Warning Signs.** Warning signs or crossbars shall be placed at charging doors to indicate that men are working in the cupola.

4. **Loitering.** Men shall not loiter under the charging platforms because of the danger of objects falling from platform and the danger of escaping carbon monoxide.

5. **Eye Protection.** Safety goggles shall be worn at all times by furnace men. Special colored glasses shall be worn when looking into the furnace.

6. **Tapping Out.** Tapping out requires skill and shall be done by experienced men only. The correct method is to bring the bott up immediately over the stream of metal close to the hole at a sharp angle to prevent spattering. An extra supply of botts must be kept on hand.

7. **Tapping Bar.** The back end of the tapping bar shall never be held above the level of the hole, as the bar may puncture the sand bed and cause a run-out through the bottom.

1796

MT-PWHD-005403

0008 1086 REDACTED J-M 83

8. **Cleaning Methods.** When cleaning up refuse from behind furnaces, men must look out for persons passing below.

0941. CRUCIBLES

1. Graphite crucibles (plumbago or black lead) shall be used instead of clay, because they withstand higher temperatures and are not so apt to break.

2. Old, worn-out crucibles shall not be ground up for use in manufacturing new crucibles.

3. Extra crucibles that have been used before shall be kept on hand as standbys in case they are needed on short notice.

4. All employees shall be fully instructed on how to handle crucibles to avoid breakage.

5. New crucibles should be bought in excess of actual requirements and stored to allow them to "season." Marking date of manufacture will assist in selecting the older ones first.

6. A number shall be assigned to each crucible and a tally kept of the number of heats taken.

7. Upon receipt, new crucibles shall be examined for cracks and flaws, not only by the eye, but by tapping with a light hammer.

0942. MOISTURE IN CRUCIBLES

1. New crucibles that have become wet must be stored in a place where they will dry out thoroughly for four or five weeks before using. The roof of a continuously operated core oven is a good place for the stowage chamber.

2. Crucibles contain less than one-fourth of one percent of moisture when they come from the kilns, but on cooling and afterwards, they absorb moisture from the air.

3. Crucibles must not be placed on a layer of damp sand or on a cold floor and left for any length of time for they absorb moisture if the temperature falls materially below 250°F.

4. To anneal crucibles, except silicon carbide crucibles, they must be slowly heated to somewhat above 250°F. and allowed to "soak" at this temperature long enough to remove all moisture. If thoroughly annealed, they may then be put into service.

5. Consideration should be given to the size of the crucible, as large ones take a longer "soaking" period to reduce the moisture. In drying out No. 200 crucible, 10 hours or more should be allowed for bringing it up to 250°F. and fully 10 hours more for "soaking."

6. If its dryness is doubtful a crucible must next be heated for some hours to a dull red heat and allowed to cool again, very slowly, to about 250°F. In any case, crucibles must be at 250°F. or over, when they go into the furnace.

0943. PREVENTING CRACKS IN CRUCIBLES

1. Crucibles must not be quickly subjected to high temperature if considerable moisture is present, as the walls may expand and cause ruptures or cracks. The same is true in natural contraction of the drying crucible.

2. Crucibles must be checked for small "pinholes" and "skelping" caused by rapid expansion or contraction. These defects are the chief causes of failure at a critical time during pouring or while crucible is being pulled from the furnace. It may rupture and spill metal on hands or feet.

3. When crucibles are heated with fuel containing too high a percentage of sulphur, or in oil furnaces using too little oil or too much steam, fine cracks (called alligator cracks) often cover the surface of the crucible.

4. Operators must thoroughly understand that when using an oil furnace, an excess of air or steam, or insufficient supply of oil, may cause an oxidizing action.

5. When crucibles are stored on top of furnaces, operators must be sure the furnace covers fit properly. Carelessness may cause

1797

MT-PWHD-005404

0008 1087 REDACTED J-M 83

moisture to be given off from the gases when fresh fuel is placed on the fire; the moisture is likely to come in contact with crucibles and cause alligator cracks.

0944. HANDLING CRUCIBLES WITH TONGS

1. Care must be used in handling crucibles with tongs and shanks. Where tilting furnaces are used, as many as 50 heats are possible from a crucible; but if crucibles have to be removed by tongs, they can be used on an average of only 15 heats.

2. Because a crucible is soft and plastic at white heat, it may be squeezed out of shape by the excess pressure of forcing the handles of the tongs together. This will gradually weaken the walls and eventually cause a complete rupture, with serious burns to operators.

3. There are three styles of tongs in general use—one pronged, two pronged, and spade tongs. Tongs must fit perfectly from the widest part of the crucible (usually called the "bilge" or "belly") down to within a few inches of the bottom. Tongs should not extend to the extreme bottom, because of the difficulty in placing the crucible in the shank.

4. Proper use of tongs consists in holding the crucible below the bilge and lifting it so that the least possible pressure is exerted on the crucible walls.

5. One pronged tongs should be used for small crucibles, up to size No. 40. Never use one pronged tongs for large crucibles ranging from No. 200 to No. 300.

6. At least two pairs of tongs shall be provided for each size crucible; one pair may become badly bent or worn.

7. Melters must never drive down the ring of the tongs by using a skimmer or other tool. This practice will cause cracks.

8. Never use improperly fitted tongs. It is important to see that tongs fit the crucible to prevent spillage of metal.

9. Never alter two pronged tongs by cutting off the lower prong even if there is a lack of space in the furnace.

10. A set of cast iron forms shall be used to restore tongs to their proper shape. To restore the tongs to their original form it is only necessary to put them in the furnace, raise them to a red heat, clamp them to the proper iron form, and bring them back into shape by means of a heavy hammer.

11. Crucibles and tongs must be kept free of clinkers, coal, or coke, to prevent forcing foreign material into sides of crucibles when grasped by tongs.

12. The bottom surface (outside) of a crucible must be free of any foreign material to prevent uneven distribution of weight and concentration on projecting spots.

0945. METAL IN CRUCIBLES

1. Ingots must not be thrown into the crucibles in haste as this may cause dents in the sides or bottoms that can eventually develop into cracks or fissures.

2. Ingots must not be crammed into crucibles, because of the danger due to expansion of the metal while heating, which can cause cracks to form.

3. Care must be taken to see that all molten metal is poured from crucible because the cooling of any residual mass will create a strain on the crucible.

0946. CLEANING AND FINISHING ROOMS

1. **Moving Castings.** Castings must not be moved through the foundry by magnetic crane.

a. **Steel Castings.** Workmen shall be instructed as to the proper method of attaching slings or chains on the heads or risers of steel castings.

b. **Iron Castings.** Slings or hooks shall not be attached to the heads of iron castings.

1798

MT-PWHD-005405

REDACTED
J-M 83

2. **Inspection.** A thorough inspection of casting containers, slings, and hooks shall be made at regular periods.

3. **Crane Signals.** A standard set of signals shall be used to guide the crane operator. Signals shall be given by one man only.

4. **Flogging Floor.** All men working on roughing or flogging floor shall wear eye protection and safety shoes. Shields shall be placed between workmen to stop flying chips and nails.

5. **Sand Removal.** When removing heads and risers by cold-cutting saws, all sand shall be removed from the casting before placing it on the saw table.

6. **Chipping.** Chippers shall be sure to use good chisels and hammers, and to wear eye protection. Chipping should not be done in the open; some method of screening should be provided to prevent flying particles from striking personnel in the area.

7. **Annealer Pits.** Chainmen entering large annealer pits shall wear safety belts with lifelines, and wooden-soled safety-toe shoes.

8. **Welding.** Gas or electric welding shall be done in a segregated area with shields around work to prevent other persons from coming in contact with the injurious rays. Operators shall be equipped with burners' safety goggles for gas welding, and electric welders shall wear the approved shields and in addition both shall wear leather aprons, leather gloves, spats, and safety shoes.

9. **Hydraulic Presses.** Where hydraulic presses are used for straightening steel castings, the press blocks should be grooved to prevent flying out. Operators should place a heavy wire screen between the press and themselves.

10. **Hand Tools.** When possible, all hand tools, including portable pneumatic or electrically driven tools should be returned to the tool room at the end of each day for inspection, electrical test, and for any necessary repairs.

11. **Compressed Air.** Compressed air shall never be blown towards anyone, used for cleaning of personal clothing, or used to cool a person off.

FORGES

0950. PERSONAL PROTECTIVE EQUIPMENT

1. All personnel in the forge shop shall wear safety shoes, leather aprons, and safety spectacles at all times. Personnel working in areas of hazardous noise levels shall wear appropriate hearing protectors (see article 0215). Other special personal protective equipment is prescribed in succeeding articles of this chapter.

2. Persons working at heating ovens shall wear the proper shade number glasses.

0951. TOOLS

1. Turn unsafe tools such as burred flatters, bevelers, shapers, etc., into the tool room for redressing.

2. To prevent tripping hazards, place all tools in proper racks provided to keep them off the floors.

3. Tongs, hammers, files, chisels, and shaping tools should be well dressed, have good handles, and be free from cracks.

4. Material should be adequately screened when doing any chipping by hand or with pneumatic tools.

0952. HAMMERS, SHEARS, PRESSES

1. **Inspection.** Before using hammer, shear, or press, the operator shall see that everything is in good order. If anything is wrong, the supervisor shall be so advised.

2. **Heating Die.** Never operate hammer when dies are cold. Always preheat dies by

MT-PWHD-005406

0008 1089

REDACTED
J-M 83

inserting hot bar, then closing dies. This method reduces the chances for cracking or breaking dies.

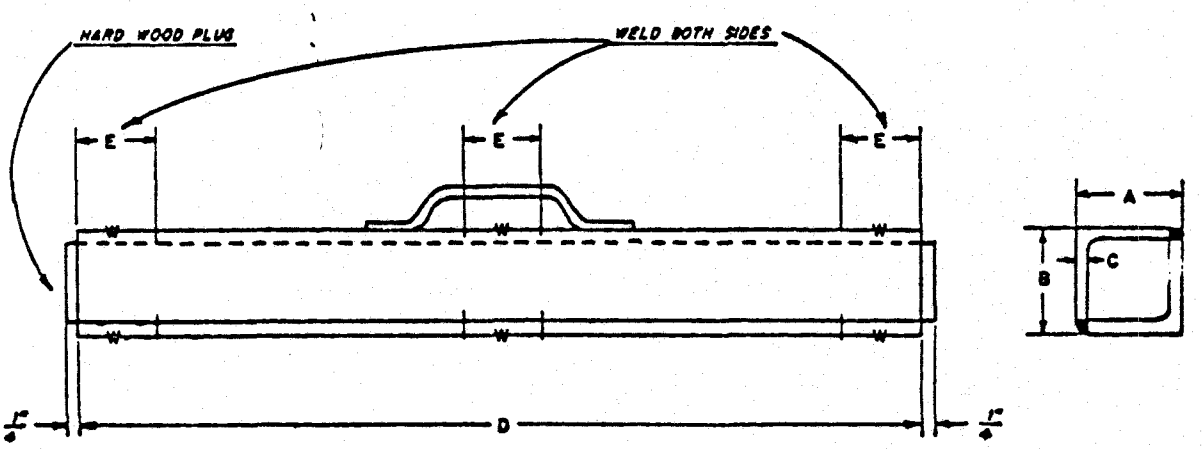
3. **Guards.** Never operate hammer without first adjusting scale guards to proper position.

4. **Changing Die.** In changing dies or making repairs always place a substantial safety prop under the hammer, shear, or punch. (See illustration, "Forging Hammer Safety Props.") In the case of steam or air hammers, be sure the supply valve is tightly closed, and a warning sign placed on the valve.

5. **Repairing Equipment.** In all cases block the treadles to prevent accidental tripping while working on dies or hammers. When repairs have been completed, and before the power has been turned on, remove all tools and loose material. When shimming dies, always place key or steel bar on top of dies, allowing plenty of hand clearance in case the ram accidentally descends. When setting dies make sure that the keys do not project too far beyond the front of ram, as they might cause injury.

6. **Stopping Hammer.** At the end of the shift or when steam hammer is not running, always leave the ram resting on the bottom to prevent accidental tripping or injury to persons passing nearby.

7. **Blowing Lines.** Before adjusting scale-blowing lines (either air or steam), be sure hammer is not in motion, and that ram is properly blocked up.



FORGING HAMMER SAFETY PROPS

MATERIAL—ANGLE IRON

Rated hammer blows (lbs.)	Dimension of angle iron (inches)					Actual load on columns (lbs.)	Collapsing load on columns (lbs.)	Present factor of safety
	A	B	C	D	E			
2000	1¾	1¾	¼	35	6	2400	57500	23. 9
3000	1¾	1¾	¼	40	6	3870	50146	12. 95
5000	2	2	⅜	40	8	6080	50146	8. 46
8000	2	2	⅜	45	8	10600	80200	7. 57
12000	2½	2½	⅜	48	10	15000	122500	8. 15
20000	2½	2½	⅜	48	10	24000	122500	5. 15
25000	2½	2½	⅜	48	10	30000	122500	4. 15

Note: Collapsing load determined by using Rankine's formula for short columns.

1800

MT-PWHD-005407

REDACTED
J-M 83

8. Swabbing Dies. In swabbing dies, use swabs which are long enough so the hands do not get under the dies.

9. Treadle and Flywheel. Keep all stock, flash, and other material away from treadle mechanism and flywheel guards.

10. Clogged Die. If material sticks in the die, it shall be removed with a stick or a soft metal tool, or it shall be reported to the supervisor.

11. Dangerous Acts

a. Never put head or hands between dies unless dies are positively blocked up, power shut off, and a warning sign attached to supply valve, switch, or starting lever.

b. Avoid stepping on hot flash.

c. Avoid standing in front of operating hammers unless it is a part of the job.

d. Never stand in front of hammers while they are being propped.

e. When operating shears, never put fingers between gages and shears.

f. Always wear safety spectacles and safety shoes on drop forge and hammer work.

12. Mufflers. The exhaust of steam or air hammers shall be provided with mufflers to attenuate the noise or shall be piped out of the working area.

0953. FURNACES–OIL OR GAS

1. Lighting Furnace. When lighting furnace, first see that all furnace doors are open. Insert a burning piece of oily waste on a long rod into the furnace. Allow fuel to flow over the waste and ignite. If air is used, turn it on slowly.

2. Personal Protection. Always wear safety spectacles or plastic eye shields when lighting furnaces and it is good practice to turn head away to avoid possible flash back. Also see that no one else is in a dangerous position.

3. Relighting. Before relighting furnaces, shut off fuel, and wait long enough for gases to escape. In oil furnaces see that draft plates are properly adjusted.

0954. DIPPING MATERIAL

1. Preheating. Material, tools, baskets, etc., shall be preheated before being placed in hot oil, cyanide, lead, hardening or drawing salt, etc., in order to prevent an explosion.

2. Fire Protection. Oil shall not be allowed to collect on floor.

3. Carburizing Compound. Never leave fire burning over night in carburizing packing compound.

4. Personal Protection. Cover-all type eye protection similar to rubber acid goggles, as well as aprons and safety shoes, preferably high type, shall be worn when dipping forgings.

0955. POTASSIUM CYANIDE AND SODIUM CYANIDE

1. Dangers. Case hardening compounds are deadly poison. Every possible precaution shall be taken to keep persons from getting the compound in their mouths or in breaks on the skin, or from breathing the vapors.

2. Ventilation. Adequate ventilation shall be provided for all personnel during exposure to cyanide hazards.

3. Personal Protection. Chemical goggles and rubber gloves shall be worn when handling these hardening compounds. Dust respirators will afford adequate protection against inhaling cyanide dusts but approved hydrogen cyanide gas masks should be worn in the presence of vapors or fumes liberated from cyanides in solution.

4. Contamination of Food. Food must never be stored, handled, or consumed in the vicinity of cyanide solutions.

5. Smoking. Smoking is prohibited while personnel are handling cyanides or when they are in the vicinity of cyanide solutions.

6. Moisture and Acids. Cyanide must be kept away from moisture and all acids.

MT-PWHD-005408

0008 REDACTED
J-M 83

7. **Containers.** Material shall be stored in airtight metal containers and kept in a locked cabinet, box, or drawer. Each container must be labeled as to contents and marked POISON.

8. **Opening Containers.** Cyanide containers shall not be opened except in the building or room where they are to be used. Unopened drums must remain in stores away from all acids.

9. **Stowing.** After removing the cover, cyanide shall be stowed in the original container until used, unless it is impractical to do so.

10. **Removing from Container.** When removing cyanide from a container, use a metal scoop and gloved hands, or dump the container as required.

11. **Breaking Fused Block.** Should cyanide be fused in a solid block in the container, crack it up into smaller pieces by hitting the container with a sledge hammer before opening. Never crack it with cover removed.

12. **Heat Treating Salts.** It is understood that "Perlition Liquid Heat" contains cyanide, and that other heat treating salts, identified by pink color, contain nitrates or nitrites. Attention is directed to the fact that cyanides and nitrates or nitrites react violently when heated together and a disastrous explosion may result. Accordingly, adequate precautions shall be taken to insure that "Perlition Liquid Heat" manufactured by E. F. Houghton Co., is not mixed with other heat treating salts.

0956. TUMBLING BARREL

1. **Cleaning.** A dust respirator, gloves, safety shoes, and dust-tight goggles shall be worn when cleaning out rust and dirt from tumblers.

2. **Wetting Down.** Wetting down of residue in tumbler will assist in preventing a dusty condition.

3. **Rust Disposal.** The rust, etc., shall be placed in a container and moved to outside area for disposal.

4. **Noise Reduction.** Tumbling barrels shall be isolated or acoustically treated so as to reduce noise below hazardous levels.

0957. CRANES

Only one person in each gang shall be assigned the responsibility of giving the signals to crane operators. Manually operated wall or jib cranes must be tended only by experienced personnel.

METALS AND METAL TREATMENTS

0960. TOXIC METALS

Many metals, such as beryllium, cadmium, lead, and zinc, involved in metal working are toxic in varying degrees and any processes whereby the metal is subjected to grinding, turning, heating, etc., which may generate dust particles or fumes should be surveyed for possible hazards. See Chapter 20 for the health hazards of and pertinent precautions for specific metals.

0961. MAGNESIUM ALLOYS

Care should be exercised in the melting and machining of magnesium and its alloys. Suitable fire extinguishers (see article 0206) shall be readily available during such operations. The accumulation of chips and turnings during machining operations should be avoided.

0962. HEAT TREATING

1. **Exposure of Personnel.** All heat-treating equipment shall be operated and maintained to minimize hazardous exposure to carbon monoxide, hydrogen cyanide, lead and its compounds, mercury, sulphuric acid, etc.

1802

MT-PWHD-005409

0008 10 REDACTED J-M 83

2. **Furnaces.** Heat-treating furnaces shall be of approved design.

3. **Poisonous Fumes and Gases**

a. Salt Pots. It is essential that no moisture be introduced into a molten salt bath. Salt pots shall be adequately ventilated since they often emit poisonous fumes.

b. Protective Atmosphere Furnaces. Manufacturer's instructions on the use of protective atmosphere furnaces shall be carefully studied and followed.

c. Combustible Gas Pockets. All types of ovens which are either gas or oil fired, such as core ovens, baking ovens, annealing or ladle ovens, shall be constructed so that all internal parts can be purged of combustible gas pockets before the burners are lighted.

d. Danger Signs. During any work involving poisonous fumes and gases, the area shall be placarded with appropriate danger signs, such as "Danger, Poisonous Fumes."

0963. PICKLING

Chemical goggles, rubber gloves, and acid resistant safety footwear shall be worn by men in dipping and pickling rooms.

0964. ELECTROPLATING SHOPS

The following basic rules for safety shall be followed by all personnel connected with electroplating shops:

1. A deluge-type safety shower shall be installed over the center of each work aisle.

2. The ventilation system must be in operation at all times when plating tanks are uncovered.

3. Personnel must wear proper protective clothing, such as acid-resisting gloves and aprons, goggles and face shields, moisture-proof shoes, etc.

4. A rigid system of preventive maintenance of equipment shall be sustained. In particular, scheduled tests of automatic temperature controls must be conducted.

5. Separate storage facilities shall be provided to isolate incompatible plating solutions.

6. Personnel shall not be permitted to lunch within plating shops, and unauthorized personnel shall not be permitted to enter shops.

7. Assigned personnel shall be given physical examinations as prescribed in NCPI 792.11-1.

8. Shop personnel shall have a thorough knowledge of first aid treatment applicable to electroplating operations.

9. Only abrasive or other approved types of anti-skid floor covering shall be utilized.

10. At least two persons should be present at all times when the shop is in operation, and under no conditions should a single person be permitted to enter the shop without the security of a standby watch.

1803

MT-PWHD-005410

REDACTED
J-M 83



CHAPTER 10





MT-PWHD-005411

0008 1094

REDACTED
J-M 83

Chapter 10

WELDING

GENERAL

1001. SCOPE

This chapter shall be used as the safety code for naval activities in the operation of equipment used in welding, cutting, and allied processes. For processes not specifically covered herein, the USA Standard, *Safety in Electric and Gas Welding and Cutting Operations,* Z-49.1, shall be used as a supplementary safety code.

1002. TERMS USED

1. **Welder, Welding Operator, or Operator.** As used herein these terms are intended to designate any operator of electric or gas welding and cutting equipment (including operators of the equipment when used for heating operations).

2. **Hot Work.** Hot work is work involving welding, flame cutting, the use of open-flame equipment, or any work involving heating metal to or above a red heat. Riveting and any cold work involving the probability of striking sparks shall be considered as hot work, except when, in the opinion of the supervisor in charge, circumstances do not necessitate such a classification.

1003. LOCATION

1. **Where Performed.** The convenience of arc and gas welding and cutting lies largely in the fact that the equipment can be taken to the job and the work done in place. This very convenience, however, makes possible construction and repair jobs in confined or remote locations that have not been laid out in the expectation that such concentrated heat or mixtures of noxious or explosive gases would be introduced into that space. Therefore the preparations described in the following paragraphs are essential.

2. **Preparation of Location.** Welding and cutting operations should be conducted in locations that have been specifically designated for the purpose. Other locations may be used if they have been freed of fire hazards by removal or protection of combustible or explosive materials, liquids, or vapors, and if suitable precautions have been taken against the reaccumulation of such materials. When welding or cutting is to be done in any location other than one specifically designated for such purposes, approval of the job and of precautions to be taken shall be obtained from the supervisor in charge before operations are started.

3. **Welding Aloft.** If it is necessary for a welding operator to work on platforms, scaffolds, or runways at an elevation of more than 5 feet, provision shall be made to prevent falling. This can be accomplished by the use of railings, safety belts, lifelines, or other safeguards as specified elsewhere herein. Special precautions must be taken prior to using a basket and a crane in the vicinity of radar equipment (see article 1543). Neither the basket nor cable lines should be brought within the beam or within five feet of an operable radar, particularly of the parabolic type. Positive measures must be taken to insure that the radars will not operate with respect to rotation or radiation. Securing of radars by announcement over a sound communication equipment is not adequate. The source of power supply to radars must be disconnected and the switches tagged and those in charge of the operation shall ascertain this has been done.

4. **Prohibited Areas.** Welding or cutting operations shall not be performed on wooden

MT-PWHD-005412

0008 109 REDACTED J-M 83

piers; nor in or on the outer surface of rooms, compartments, or tanks or in areas adjacent thereto; nor on or in closed drums, tanks, or other containers which hold or have held flammable or explosive materials, liquid, or vapors, unless all fire and explosive hazards have been eliminated according to the applicable procedures specified in articles 1054 and 2070 to 2080.

5. **Fire Watch.** If all fire hazards cannot be removed from the area of welding operations or when any such operations are performed aboard ship, fire watches shall be properly instructed and posted in the vicinity. Fire watches shall be posted on both sides of deck, bulkhead, wall, or ceiling being worked on if heat or sparks exist on both sides. The fire watches shall remain at their stations for at least fifteen minutes after the job is completed to ensure that there are no smoldering fires. Fire-fighting equipment or suitable portable fire extinguishers must be available for use by the fire watches.

1004. HAZARDS

1. **Fire and Explosion.** Personnel performing welding, cutting, or heating operations in small spaces must take the recommended precautions against the ever-present hazard of suffocation or fire and explosion.

2. **Toxic Vapors.** Welding operators must guard against breathing the noxious and sometimes toxic gases which may be formed under certain conditions. Inadequate ventilation while welding may cause illnesses such as metal fume fever or metal poisoning.

3. **Electric Shock.** In electric arc welding, even low voltages may be a potential source of serious shock when certain unfavorable conditions exist. (See Chapter 15.)

4. **Eye Injury.** Eye injuries from the brilliant light of the arc or from heavy gas welding may be very serious.

5. **Body Burns.** Body burns from the arc or from molten metal are a constant danger as are burns from handling hot objects such as wires, tools, and rods.

1005. METAL CONTAINERS AND HOLLOW PARTS

1. **Drums, Structures.** Before welding, cutting, or heating is begun, drums, containers, or any hollow structures which have contained flammable substances shall either be completely filled with water or thoroughly cleaned, ventilated, and tested. Such containers shall be vented to provide for release of any built-up pressure.

2. **Hollow Parts.** Structural voids, jacketed vessels, or castings suspected of being hollow shall be drilled or vented by other means before welding, cutting, brazing, or heating is begun. The absence of flammable materials in such parts shall be ascertained before heat is applied.

3. **Inerting.**

a. **With Gas.** In an apparently clean container there may still be traces of oil or grease under the seams even though the vessel may have been cleaned and flushed with caustic soda solution. The heat of the welding or cutting operation may cause such oil or grease to give off flammable vapors to the extent that an explosive mixture may be formed inside the container. Such mixtures can be prevented from burning or exploding by mixing in a quantity of an inert or nonflammable gas equal to a substantial percentage of the volume of the vapor-air mixture. Carbon dioxide, nitrogen, and helium are suitable for this purpose.

b. **With Steam.** In making emergency repairs and when it is impractical to obtain or use one of the inert gases or to clean and gas-free the spaces, steam may be used in lieu of inert gas to blanket the compartment. However, steam shall *never* be used under any circumstances in spaces containing flammable materials in closed containers, or in magazines or spaces adjoining magazines.

1006. WELDING APPARATUS

1. **Approved Apparatus.** Use only approved apparatus, such as torches, regulators, hose, valves, electric welding machines and accessories, or specialized apparatus that have been examined and tested and

MT-PWHD-005413

REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 1004.2

Subj: Welding in the Presence of Zinc and its Compounds

Ref: (a) NAVMAT P-5100, Article 1004.2

1. GENERAL. Zinc in its various states is found in this Shipyard in pigs, sheets, rods, alloyed in casting, in liquid form in galvanizing baths, in thin films on galvanized surfaces, as a dust in zinc dust paint for ships' fresh water tanks, and is present in paint films as zinc naphthenate and zinc chromate. When zinc is heated to its vaporizing temperature, a fume of zinc oxide is formed which, when inhaled in sufficient quantity, may cause a condition known as "metal fume fever."

2. PRECAUTIONS.

a. In both welding and burning operations, adequate ventilation will be supplied before work commences. Adequate ventilation in enclosed spaces when welding and burning in the presence of zinc and its compunds means that in addition to general ventilation sufficient to maintain the working atmosphere reasonably free of contamination, local exhaust ventilation must be supplied of at least 200 cubic feet per minute for each individual cutter or welder, with the exhaust tube brought within eight inches of the actual burning or welding operation.

b. In the event adequate ventilation is not available, air-line respirators shall be worn.

MT-PWHD-005414

0008 1097

REDACTED
J-M 83

found to be safeguarded in accordance with accepted standards. Helmets, hand shields, goggles, and clothing shall be approved types made of a material which is an insulator for heat and electricity, is not flammable, and is capable of withstanding sterilization.

2. Instruction of Operators. Workmen designated to operate welding or cutting equipment shall have been properly instructed and shall be qualified to operate such equipment.

It is important that electric welding equipment be installed only by competent and experienced personnel in accordance with approved plans. This requirement is especially applicable to the installation of specialized equipment such as acetylene generators, flame hardening outfits, etc., and of primary power lines and outlets intended to supply electric welding machines. All precautions outlined by the manufacturer shall be followed in addition to all procedures set forth in this chapter under gas welding, arc welding, protection of personnel, ventilation of confined spaces, hot work in way of flammable or explosive materials, and entry into closed compartments.

3. Inspection of Apparatus in Confined Spaces. While equipment is in use, especially while operating in confined spaces, it shall be frequently inspected for evidence of leaks in the hose, couplings, valve stems, or other points of the system. If leaks are not promptly detected, an explosive or toxic mixture of gas and air may accumulate with serious results.

4. Blocking Portable Equipment. Before operations are started, heavy portable equipment mounted on wheels shall be securely blocked to prevent accidental movement.

5. Work Suspension. When work in a confined space (except in shop spaces authorized for active stowage of welding equipment) is to be suspended for any substantial period of time, such as during lunch or overnight, the following special precautions must be taken.

a. Arc-Welding Equipment

(1) All electrodes shall be removed from the holders.

(2) All arc welding equipment shall be disconnected from the source of power.

(3) All such equipment, including the electrode holder, shall be positively insulated so that no accidental contacts can be made even if the equipment is moved during this period.

b. Gas Welding Equipment

(1) Gas supply to torch. In order to eliminate the possibility of gas escaping through leaks or improperly closed valves in gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively shut off at some point outside a confined area.

(2) Removal of torch. The torch and hose shall also be removed from the gas supply during such time. For securing equipment when not in use see article 1026.7.

6. Protection of Equipment. Welding equipment used in the open should be protected from inclement weather. When not in use, the equipment should be stored in a clean, dry place.

1007. FIRE-EXTINGUISHING EQUIPMENT

1. Use of CO_2, Water Lines, and Water Pump Tanks. Suitable fire-extinguishing equipment of approved types shall be maintained near all welding and cutting operations. The suitability of the equipment shall be judged by an analysis of the conditions at the scene of operations. If, for instance, the only combustible material within range of the welding or cutting operations or sparks therefrom is bitumastic waterproofing, a CO_2 extinguisher may be adequate. However, in a small space with a very small access opening, the operator may not be able to get out quickly in case of fire and the use of CO_2 might be injurious to him. Under such conditions the use of water from a 1½-inch water line or water pump tank would be preferable.

1808

MT-PWHD-005415

0008 1098

REDACTED
J-M 83

or lead bearing paint, or low melting lead alloys must wear an air-line respirator. When conditions do not permit the use of an air-line respirator, a filter type respirator equipped with fume filter pads may be worn, along with adequate ventilation, for short intermittent periods of work only.

2. Zinc Metals. When welding, burning, or heating zinc-bearing base or filler metals or metals coated with zinc-bearing materials, adequate exhaust ventilation must be provided and a filter type respirator equipped with fume filters shall be used by employees performing hot work and also by others in the vicinity. The ventilation system should exhaust to the outside atmosphere.

3. Rubber and Plastic Coated Materials. Filter type respirators shall be required for welding, burning, or heating operations on metals coated or backed by synthetic rubber, saran, vinyl plastic, polyurethane foam-in-place plastics, bitumastic paints, and preservatives.

4. Scheduled Operations. Welding, burning and heating operations, especially those emitting hazardous fumes, should be scheduled so as not to interfere with other trades working in the area. When conditions do not permit this, adequate ventilation must be provided and other employees exposed to hazardous fumes shall be protected with the same respiratory equipment as welders and burners. Supervisors shall make frequent inspections to ensure that this measure is strictly enforced.

5. Welding Inside Closed Containers. Where welding operations are carried on inside tanks or other closed containers, air-line respirators or hose masks should be furnished the men so employed. A workman shall be stationed on the outside to service the power, gas, and ventilation lines to ensure the safety of those working within. The attendant shall observe the welding operator at all times and in case of emergency shall immediately shut off the gas or electric current and render such other help as the occasion warrants. A filter type respirator may be used only for short periods of time.

a. Safety Belts and Lifelines. Where a welding operator must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of emergency. Safety belts and life-lines used for this purpose shall be so attached to the operator's body that the body cannot be jammed in a small exit opening.

b. Communication. When men are in tanks and other such spaces, even after such spaces have been cleaned and found *SAFE*, a reliable man shall stand outside at the manhole and keep count of the men in the space and communicate with them every few minutes to be sure that no one has been overcome by toxic gases.

1013. WARNING ABOUT HOT METAL

After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning other workers.

GAS WELDING

1020. CYLINDERS

Following are a few special precautions concerning cylinders in actual use in welding or cutting or in *active stowage* (ready service). For more complete and detailed precautions for the handling and stowage of fuel gas and oxygen cylinders refer to the section on compressed gases in Chapter 20.

1. Call by Proper Names

a. Fuel Gases. Fuel gases should be called acetylene, hydrogen, etc., and not by the word "gas", which is a general term including oxygen, etc.

b. Oxygen. Oxygen should be called by its proper name—not, for example, by the word "air".

1811

MT-PWHD-005416

0008 1099

REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 1020

Subj: Oxygen and Acetylene Welding and Cutting Operations

Ref: (a) NAVMAT P-5100, Chapter 10
(b) LBNS Safety Supplement No. 0116
(c) LBNS Safety Supplement No. 0653.2

1. PURPOSE. To supplement reference (a) with the procedures for maintenance and inspection of oxygen and fuel gas equipment used in gas welding, brazing, and cutting operations.

2. GENERAL. The hazards encountered in the use of oxygen and acetylene are generally recognized. Individually or in combination, these gases permit rapid combustion and consequent danger to personnel and equipment. All precautions relating to the use of these substances as outlined in reference (a) will be strictly adhered to. Particular emphasis must be placed on the need to educate all shipyard personnel in the hazards involved, the applicable precautions and the proper use of these gases.

3. PERMANENTLY INSTALLED DISTRIBUTION SYSTEMS. The Public Works Department, (Shop 03) is responsible for the provision, inspection, maintenance and distribution of all permanently installed distribution systems up to and including distribution outlet. This will include:

a. Monitoring the usage of oxygen and acetylene every four hours during periods when all risers are shut and in conjunction with Shop 99 investigate all excessive usage. When the cause of excessive usage is found, take immediate corrective action. All unexplained discrepancies will be reported to the Shipyard Watch Officer.

b. Application of color code to distribution lines in accordance with the Standard Color Code.

4. TEMPORARY SERVICE LINES AND DISTRIBUTION MANIFOLDS. The Production Department (Shop 99) is responsible for the provision, installation, routine inspection and maintenance of temporary service lines and distribution manifolds throughout the Shipyard. This will include:

a. Installation of manifolds upon request of the using shop. Main valves supplying manifolds will not be turned on by the user under any circumstance. This is a Shop 99 function.

b. Securing all risers to these systems at 2400 unless appropriate shops request they remain open in order to accomplish work between 2400 and 0730. Shop 99 will reopen the riser valves by 0730 the following workday.

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J-M 83

c. Ascertaining that there are no leaks in temporary service lines or manifolds.

d. Replacement of faulty equipment.

e. Repairs to manifolds and hoses.

f. Removal of all hoses and manifolds upon completion of work assignments.

g. Test of equipment at least every ninety days.

5. MANIFOLD CONNECTIONS. Oxy-Acetylene gas distribution manifolds are supplied for use in shipyard burning and welding operations. They are to be used by authorized shipyard employees only. Ships force will not make connections to manifolds or use equipment connected by shipyard personnel.

6. MANIFOLD WARNING SIGNS. Shop 99 will have manufactured and will install warning signs on all oxygen/acetylene manifolds. The warning signs will be made in accordance with reference (b) and will contain the following message: CAUTION----oxygen and acetylene for use by Shipyard Personnel Welding and Burning Only----unfit for other use.

7. TORCHES AND REGULATORS. The Production Department (Shop 06) is responsible for the procurement, stowage, issue, accountability, routine inspection, tests and necessary repairs of torches and regulators. This equipment will be returned to Shop 06 at least once every 30 days for inspection and repairs as required.

8. WORK INTERRUPTION PERIODS. On work interruptions, never leave oxy-acetylene equipment where it is subject to fire, sparks or other damage.

a. On Destroyers or smaller type ships. During lunch periods or when leaving the work area for any length of time, remove the torch and hose from work area to open air. Shut off valves at manifold, back off regulators, and pocket the key.

b. On Crusiers and the larger type ships. Secure the valves at manifold and remove torch and hose to open area. On long runs, with specific permission of the foreman only, the torch and hose may be left in the work area. In such case, manifold valves must be closed and hose disconnected from manifold.

9. ESCAPING GAS. Anyone detecting escaping gas will immediately notify the Officer of the Deck, Ship Superintendent, Shop 99, Public Works Department Trouble Desk (Ext. 7302/7347 during day shift) and the Shop 03 Dispatcher (Ext. 8287) of this condition. The area will

MT-PWHD-005418

immediately be secured and no hot work performed until clearing of the area of gases has been accomplished and the area has been certified safe by a Gas Free Engineer (Ext. 6541/6542).

10. FIRE WATCHES. Welders will ensure that fire watches are in the proper space before commensing welding operations. This will include rapping on the boundaries of the weld site when applicable. Further instructions concerning the requirements for fire watches are contained in reference (c) and will be strictly adhered to.

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MT-PWHD-005419

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J-M 83

2. Mixing Fuel Gases and Air or Oxygen. Mixtures of combustible gases and air are very explosive and shall be carefully guarded against. No device or attachment facilitating or permitting mixture of air or oxygen with combustible gases prior to consumption, except at the burner or in a standard torch or blow pipe, shall be allowed unless approved for the purpose.

3. Assigned Locations. Keep all cylinders in definitely assigned locations:

a. well ventilated and away from corrosive chemicals and fumes;

b. away from radiator or other source of heat or fire; in summer, away from direct rays of the sun;

c. away from elevators, stairs, or gangways;

d. free from danger of being knocked over or damaged by heavy objects passing or falling;

e. where they cannot form part of an electric circuit;

f. away from combustible material, especially grease and oil;

g. far enough away from the actual welding or cutting operations so that sparks, hot slag, or flame will not reach them.

4. Securely Fastened. Cylinders in use or in stores or cargo shall be securely fastened to prevent shifting or falling under any weather conditions.

5. Confined Spaces. When welding or cutting is being performed in any confined space with difficult means of exit, the gas cylinders and heavy welding or cutting equipment shall be left on the outside.

6. Protection From Ice. Cylinders in the open should have valves and safety devices protected against accumulations of ice and snow. Warm (not hot) water shall be used to thaw ice in cylinder valve outlets.

7. Excessive Heat. In summer, cylinders in the open shall be screened from the direct rays of the sun to protect against excessive temperature rises. (The maximum temperature to which cylinders should be subjected is 130° F. Higher temperatures may cause dangerous pressure increases.)

1021. FUEL-GAS CYLINDERS

1. Vertical Position. Acetylene and liquified fuel-gas cylinders shall be placed with valve-end up whenever they are used. They should also be stowed in this position and not allowed to lie on their sides. If horizontal stowage is necessary, cylinders must be in vertical position 2 hours before using. Otherwise acetone in which the acetylene is dissolved will be drawn out with the gas.

2. Leaking Cylinders. If a leak develops at the fusible plug or elsewhere on a cylinder, the cylinder shall be removed well away from any source of ignition, the cylinder valve slightly opened, and the fuel gas allowed to escape slowly. A warning shall be placed near this cylinder not to approach it with a lighted cigarette or other source of ignition. Such a cylinder shall be plainly tagged as defective and in need of repair before refilling.

3. Protection of Safety Plug. When cylinders are in use, nothing shall be placed on top of an acetylene cylinder which may damage the safety plug or interfere with the quick closing of the valve.

4. Pressure of Acetylene. Under no conditions shall acetylene be generated or used at a pressure in excess of 15 pounds p.s.i. gage pressure. This requirement is not intended to apply to the storage of acetylene dissolved in a suitable solvent (such as acetone) in cylinders manufactured according to Interstate Commerce Commission requirements and to applicable specifications.

5. Liquid Acetylene. The use of liquid acetylene in welding is prohibited.

1022. OXYGEN CYLINDERS

1. Keep Away from Oil and Grease. Keep oxygen cylinders and fittings away from oil and grease, which in the presence of oxygen under pressure, may burst into flame. A jet of oxygen shall never be permitted to strike

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an oily surface or greasy clothes, or to enter a fuel oil tank or other compartment that has contained a flammable substance. Every possible precaution shall be taken to prevent oily and greasy substances from coming in contact with cylinders and cylinder valves. Do not handle oxygen cylinders, valves, regulators, hose (oil or grease deteriorates rubber), and other apparatus or fittings with oily hands, gloves, or greasy materials. Cylinders shall never be stowed or used where oil or grease from machinery or overhead cranes or belts can splash or fall upon them. Oxygen will not burn, but it supports and accelerates combustion and will cause oil and other flammable materials to burn more easily and with greater intensity.

2. **Keep Away from Combustibles.** Do not store oxygen cylinders near highly combustible material, especially oil and grease; or near reserve stocks of acetylene or other fuel gas cylinders; or near any other substance likely to cause or accelerate fire.

3. **Not a Substitute for Compressed Air.** A serious accident may easily result if oxygen is used as a substitute for compressed air. Never use oxygen in pneumatic tools, in oil preheating burners, to start internal combustion engines, to blow out pipe lines, to "dust" clothing or work, to create pressure, or for ventilation.

1023. CYLINDER VALVES

1. **Protection Cap.** Valve protection caps are designed to protect valves from damage. Before raising cylinders from a horizontal to a vertical position, the cap should be properly in place, should be turned clockwise to see that it is hand-tight, and then the cylinder should be raised by grasping the cap. Hooks or line through valve protection caps shall not be used for lifting cylinders from one vertical position to another. Bars shall not be used under cylinders and particularly not under valves or valve-protection caps to pry cylinders loose. When frozen to the ground or deck the use of warm (not boiling) water is recommended. Valve-protection caps shall always be in place except when cylinders are in use or connected for use.

2. **Open Valves Slowly.** Cylinder valves shall always be opened slowly.

3. **Never Repair Valves.** Never tamper with nor attempt to repair cylinder valves. If trouble is experienced, indicate on a "defective" tag the nature of the trouble and return the cylinder to the supplier.

4. **Do Not Force Valves.** Do not use a hammer or a wrench to open cylinder valves. If valves cannot be opened by hand, tag them as defective and in need of repairs before recharging.

5. **When the Oxygen Cylinder Is in Use.** The valve should be opened at least one full turn, preferably all the way, to prevent leakage around the valve stem. Avoid complete removal of stem from a diaphragm type valve (it might be lost or dirt might enter the mechanism).

6. **Opening Acetylene Valves.** An acetylene cylinder valve open ¼ to ½ turn will permit an adequate flow of gas; and in order that the valve may be turned off quickly in case of emergency, it should not be opened more than 1½ turns.

7. **Keeping Wrench Available.** Where a special wrench is required it shall be left in position on the stem of the valve while the cylinder is in use so that fuel gas can be quickly turned off in case of emergency. In the case of manifolded or coupled cylinders, at least one such wrench shall always be available for immediate use.

8. **Closing Valves.** Valves shall be closed under the following conditions:

   a. before moving cylinders;
   b. when work is finished;
   c. when cylinders are *empty*.

9. **Leaking Around Valve Stem.** If there is a leak around the valve stem when a fuel gas cylinder is opened, the valve should be closed and the gland nut tightened. If this does not stop the leak, the use of the cylinder should be discontinued. The cylinder shall be plainly tagged as defective and in need of repairs before using or recharging. If the need to use the cylinder is very urgent,

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MT-PWHD-005421

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J-M 83

the leak can probably be stopped by opening the valve all the way; but this should be done only when emergency conditions requiring quick closing of the cylinder valve are not likely to occur.

10. Leaks in Piping. Tests for leaks of any piping system or apparatus shall be made with soapy water. Use grease-free soap. NEVER EMPLOY FLAMES TO DETECT LEAKS.

1024. REGULATORS

1. Pressure-Reducing Regulator. Cylinders shall not be used without first attaching an approved pressure-reducing regulator to the cylinder valve or to a manifold.

2. Cracking Cylinder. Before connecting the regulator to the cylinder valve, the valve shall be opened one quarter of a turn and closed immediately. This action is generally termed "cracking" and will clear the valve of dust or dirt that otherwise might enter the regulator. Always stand to one side of the outlet when opening the valve. Never "crack" a fuel gas cylinder near other welding work or near sparks, flame, or other possible sources of ignition. Be sure the regulator is closed (the adjusting screw backed out until loose) before opening the cylinder valve.

3. Connecting Regulator. When a regulator is attached, open the cylinder valve slightly at first so that the regulator cylinder-pressure gage hand moves up slowly. If the pressure is suddenly released, it is likely to damage the regulator and pressure gages.

4. Right- and Left-Handed Threads. Threads on oxygen regulator outlets, hose couplings, and torch valve inlets are right-handed, and those for acetylene are left-handed. Threads on acetylene cylinder valve outlets are right-handed, but of different pitch from oxygen cylinder valve outlets. If threads do not match, the connections are mixed. Do not attempt to force unmatching or crossed threads.

5. Acetylene Valve Outlet. When setting up cylinders for use, the acetylene valve outlet should be pointed away from the oxygen cylinder.

6. Personnel in Front of Pressure Gage. When valves are opened no one should be allowed to stand in front of the pressure gages.

7. Metal Tools. Metal tools (even the so-called sparkless type) for making repairs shall be used with caution to avoid striking a spark. Such a spark may cause ignition if a mixture of gas and air is present.

8. Modification of Regulators Prohibited. Regulators or automatic pressure-reducing valves shall be used only at the pressures and for the gas for which they are intended. Do not experiment with regulators or modify them in any way.

9. Testing Gages on Regulators. Working on low pressure gages attached to regulators should be periodically tested to ensure their accuracy. Do not test oxygen gages with oil.

10. Faulty Threads or Nuts. Union nuts and connections on regulators should be inspected before use to detect faulty or dirty threads or seats which may cause leakage of gas when the regulators are attached to the cylinder valves. When damaged nuts or connections are found, they shall be removed from service. Dirty threads or seats shall be cleaned.

11. Clear Working Space. Keep a clear space between the cylinders and the work so that the cylinder valves can be reached easily and quickly if necessary.

12. Low Pressure Within Cylinder. The use of any cylinder shall be discontinued before the pressure falls to zero. Oxygen cylinders, particularly, shall not be used in welding or cutting operations, except in an emergency, after the gage pressure falls below approximately 25 p.s.i. Cylinder valves shall then be securely closed and valve protecting caps replaced. These practices prevent moisture, other gases, etc., from contaminating the cylinder before it is refilled. Such cylinders shall be tagged or marked "empty" or "MT". Empty cylinders shall be segregated from full cylinders, but shall be

MT-PWHD-005422

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stowed in the same compartments (or on deck) and otherwise handled with the same precautions specified for full cylinders.

13. **Removal.** Before a regulator is removed from a cylinder valve, the cylinder valve shall always be closed and the gas released from the regulator.

1025. PORTABLE MANIFOLDS

When it is necessary to discharge fuel gas or oxygen simultaneously from several cylinders in order to provide sufficient volume for heavy work on several concurrent jobs, a portable manifold (sometimes called a coupler block) may be used to connect the cylinders to a single regulator or to a single header having several outlets with individual regulators. Portable manifolds shall be of substantial design and capable of safely withstanding any pressure to which they may be subjected in operation.

1. **Copper with Acetylene.** "Pure" copper, or copper alloys containing 67 to 99 percent copper, shall NOT be used in piping or fittings for handling acetylene (except blowpipe or torch tips). Acetylene reacts with pure or slightly alloyed copper to form cuprous acetylide, a violent explosive.

2. **Flash Arresters.** When several fuel gas cylinders are manifolded, approved flash arresters shall be installed between each cylinder and the manifold. For outdoor use only and where the number of cylinders manifolded does not exceed three, one flash arrester installed between manifold and regulator is acceptable.

3. **Back-Flow Valve.** Each cylinder lead should be provided with a back-flow valve.

4. **Capacity.** The aggregate capacity of manifolded fuel gas cylinders shall not exceed approximately 2,000 cubic feet of gas.

1026. THE TORCH

1. **General.** The following precautions, including procedure for lighting, adjusting, and extinguishing torch flames, shall be carefully followed. Closed and poorly ventilated compartments shall be inspected and approved by an authorized person prior to conducting any hot work. Special precautions indicated by the manufacturer of any apparatus shall also be carefully carried out.

2. **Tip or Nozzle Pressure.** Always use the proper tip or nozzle, and operate it at the correct pressure for the particular work involved. This information should be taken from tables or work sheets supplied with the equipment.

3. **Suitable Source of Ignition.** Do not use matches for lighting torches or serious hand burn may result. Use friction (spark) lighters, stationary pilot flames, or some other suitable source of ignition.

4. **Lighting Torch.** When lighting the torch, open the acetylene valve first and ignite the gas while the oxygen valve is still closed. Do not allow the unburned acetylene to escape into small or closed compartments.

5. **Lighting Torch in Confined Space.** Do *not* attempt to light torches from hot metal. An explosive mixture of acetylene and oxygen can accumulate quickly and may cause damage or personal injury if ignited. Do *not* allow such a mixture to accumulate. Particularly, do not be slow to light a torch, especially a large one for heavy work. A stationary pilot flame, such as a candle, shall be used in lieu of a spark lighter in a confined space.

6. **Extinguishing Torch.** When extinguishing the torch, close the acetylene valve first, then close the oxygen valve.

7. **Securing Equipment When Not in Use.** When welding or cutting is stopped and will not be resumed within 15 minutes, or when the operator leaves the scene for any period of time, the equipment shall be secured as follows:

a. Extinguish the torch as in (6) above.

b. Close both acetylene and oxygen cylinder valves. (Leave regulators open momentarily.)

c. Open acetylene valve on torch and allow gas in hose to escape (5-15 seconds)

MT-PWHD-005423

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J-M 83

to outside atmosphere, NOT into small or closed compartment. Close valve.

d. Open oxygen valve on torch and allow gas in hose to escape (5-10 seconds). Close valve.

e. Close both regulators. (Note—oxygen and acetylene regulators are closed when adjusting screws are backed out until loose.)

8. Regulators and Valves Clear of Hose. Do not hang a torch by its hose on regulators or cylinder valves. Make certain that the torch is not burning when not in use and that the valves are closed tightly.

9. Valves Tightly Closed. If, after equipment has been in use, it is to be stowed for a considerable period before being used again, it shall be inspected carefully to determine that cylinder and torch valves are firmly closed, regulators are closed (adjusting screws released), and all hose connections are tight. If stowed thus, it is not likely to create any explosion hazards in the compartment in which stowed, and it can be put back into use at any moment.

10. To Prevent Backfiring. If equipment has been stowed with torch valves open or loosely closed or with hose connections loose, or if hoses and torch are being newly connected prior to use, or if either of the cylinders has just been changed, there is danger of backfiring unless all connections are made tight and the system "purged" of air as follows before the torch is lighted.

11. Purging System of Air. Be sure torch valves are firmly closed; then open cylinder valves slowly. Open regulators slightly. Open torch acetylene valve and allow unlighted gas to escape to the outside atmosphere, *not* into a small or confined space. Allow gas to flow for 5 to 15 seconds, depending on length of hose, until all air, or mixture of gas and air, has been forced out of the system. Then close the torch acetylene valve. Repeat the procedure on the oxygen side of the system. Then proceed with lighting the torch as above.

12. Uncapped Openings. When combustible-gas lines or other parts of equipment are being purged of air or gas, lights or other sources of ignition shall not be permitted near uncapped openings.

1027. HOSE

1. Color. Red is the generally recognized color for acetylene hose, and green or black for oxygen hose.

2. Twin Hose Lines. A single hose with two or more gas passages, in which a wall failure might permit the flow of gas from one passage into the other, or permit the mixing of gases in the hose, is not permitted. Twin hose lines made especially for oxyacetylene operations are permissible when they are substantially two hoses, held together by webbing or other means, and so constructed that gas from one hose line cannot possibly leak into the other. When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, not more than 4 inches out of each 8 should be covered with tape, otherwise it is difficult to locate leaks and identify hose.

3. Metal Clad Hose. Metal clad or armored hose is not recommended.

4. Worn Spots. Hose shall be frequently inspected for worn spots or defective connections and defective hose shall be repaired or removed from service.

1028. WELDING ON SHIPBOARD

1. Responsibility of Commanding Officer. When oxygen and acetylene or other fuel gases are to be used aboard ship, the cylinders would normally be placed as close as possible to the work. However, in construction, repair, overhaul, or conversion jobs conducted in shipyards, bases, or alongside repair ships, it becomes necessary to decide whether to allow the cylinders and outlet headers inside the ship or to keep them outside. Decision shall rest with the commanding officer and shall be based on an analysis of which set of hazards—that is, taking equipment inside or leaving it outside the ship—can be more readily safeguarded. In either event, before hot work is done in way

MT-PWHD-005424

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of flammable or explosive materials and before there is any entry into closed or poorly ventilated spaces, the commanding officer shall see that careful preparations are made as prescribed in articles 2070 to 2080.

2. Cylinders Inside the Ship

a. **Fire.** If cylinders are located inside a ship in many compartments from which they cannot be removed quickly, they may become involved in a fire. There is little danger of the cylinders themselves exploding, but the heat and pressure may open the cylinder safety devices and release the gases. Escaping fuel gases may become ignited and the flaming cylinder will add to the fire; or unburned fuel gas escaping into a confined space may form an explosive mixture before it is ignited; or escaping oxygen may cause a small fire to burn more fiercely.

b. **Handling Cylinders.** When cylinders are manhandled through doors and hatches and up and down ladders, special care must be taken to prevent injury to personnel or damage to the cylinders, which may cause an accident. On ships under construction, however, when decks are not in place, rapid and safe handling of cylinders by cranes is practicable.

3. Cylinders Outside the Ship. On the other hand, keeping the cylinders, outlet headers, etc., outside of ship, on the weather deck, the ways, or the deck, exchanges one set of hazards for another, such as:

a. **High Pressure.** Higher gas pressures and additional couplings required for longer hose lines increase the danger of gas leaks into the ship.

b. **Cutting Hose.** Hoses strung out along decks and through doors and hatches are in danger of being damaged or cut and thus flammable or toxic gases or oxygen-gas mixtures may be released into the ship.

1029. STRINGING HOSE

Whenever cylinders, portable outlet headers, or service piping outlets are left in a shop aboard ship, or on the weather deck, the dock, or some other point remote from the scene of work, and hose lines are strung out for long distances to the work, the procedure below shall be followed:

1. Connecting Apparatus. Connect regulators, hose, and torch as outlined in 1023 through 1027.

2. Trial Lighting of Torch. Light torch and adjust regulators for proper pressures. Extinguish torch, leaving supply valves and regulators open temporarily.

3. Inspection for Leaks. Inspect all connections for leaks, especially torch valve and hose connections that will go inside the ship.

4. Close Supply Valves. If no evidence of leaks is found, close the cylinder or other supply valves just behind the regulators. Leave the regulators open at proper adjustments.

5. Protecting Hose. String the hose, with torch attached, to the location of the work. If several hoses are strung through the ship, or if the work will take several hours or days, provision should be made to suspend the hoses off the deck to minimize the danger of damage and to eliminate a tripping hazard. Take all practicable precautions to ensure that doors and hatch covers are securely held open to preclude cutting of the hose by an accidentally closed door or hatch cover, and to guard the hose from damage by traffic in its vicinity.

6. Opening and Closing Supply Valves. An assistant should be assigned to maintain contact with the operator. He should be stationed where he can close the valves quickly in case of an emergency, and reopen the supply valves when directed by the operator. The work may then proceed.

a. **Securing Torch.** If assignment of a helper is not practicable, and it is necessary to adjust supply valves, the operator shall *secure the torch* where it is not likely to be disturbed—asking a shipmate or fellow worker to watch it. The operator shall be sure that torch valves are firmly closed before leaving equipment to reopen the supply valves. *He shall return immediately to the torch.*

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J-M 83

b. Inspection of Hose. On each trip the operator shall follow the hoses and inspect them for damage.

c. Relighted Torch. If, on his return, the operator detects no odor of acetylene or other indication of danger in the compartment, he may then light the torch and proceed with work.

7. Leaving Equipment Unattended. When leaving equipment unattended for even a relatively short period such as meal time, directions for securing welding equipment shall be carefully followed (see article 1026.7).

8. Care of Equipment After Using. Upon completion of work, extinguish the torch and direct the helper to *close the supply valves;* or the operator shall *immediately* do it himself. The torch and hose shall *immediately* be removed from the compartment to the outside or stowed with the cylinders in their assigned locations.

ELECTRIC ARC WELDING

1035. PROTECTION FROM SHOCK

1. Working Alone. Whenever it can be avoided, a welding operator should not work alone in a compartment. Immediate care of an operator who has received an electric shock may prevent serious consequences.

2. Care of Equipment. Welding equipment should be maintained in good mechanical and electrical condition to avoid unnecessary hazards. Commutators should be kept clean to prevent excessive flashing.

3. Voltage. All personnel must keep constantly in mind that any electric power circuit, whether AC or DC, high or low voltage, is a potential source of danger. It is important to observe every precaution to prevent shock. Although the voltages required for arc welding are low, they are enough to be a potential source of serious shock under favorable conditions.

4. Dangers from Low Voltage. One of the principal dangers from low voltage welding circuits is the totally unfounded assumption that they can be handled with impunity. The only way to be safe is to handle any electric circuit with extreme caution. The reference to "any electric circuit" is particularly emphasized because the welding operator not only handles the welding circuit, but he also may handle portable lights, portable motor-driven tools, and in many instances he may handle switches or portable cable on the side of the arc welding machine connected to the power source.

5. Keeping Body Insulated. The danger of shock is particularly marked when the operator is sweaty or wet. The operator should develop the habit of always keeping his body insulated from both the work and the metal electrode and holder. It should never be assumed that because contact at one time is not harmful, similar contacts at other times will be similarly harmless. Changes that are not noticeable can take place which could change the effects of contact.

6. Wooden Mats Used for Insulation. Whenever it is practicable, the operator should stand on dry wooden mats or similar insulating material rather than on grounded metal structure.

1036. ELECTRODE HOLDERS

1. Safe Capacity. Only electrode holders which are fully insulated and in good condition shall be used. They shall have been specifically designed for arc welding and of a capacity capable of safely handling the maximum rated current required by the electrodes with which the holder is intended to be used.

2. Insulation. Any current-carrying parts passing through the portion of the holder which the operator grips in his hand shall be fully insulated with nonconducting material

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J-M 83

capable of safely insulating against the maximum voltage encountered to ground. Electrode holders with all metallic or current-carrying parts fully insulated (including the jaws gripping the electrodes) are recognized as affording superior protection to the operator. Such holders are available in stock and shall be used whenever possible.

3. **Gloves.** Always wear gloves when handling energized holders, cables, or machines and when removing or replacing electrodes. The gloves should be dry and in good condition.

4. **Dipping in Water.** Do not dip hot electrode holders in water because this would expose the operator to the chance of receiving an electric shock.

5. **Energized Holder.** Do not put an energized electrode holder under the arm at any time. When the energized electrode holder is not in use, the operator should place it where it will not be contacted by other personnel. If an insulated surface or insulated holding peg is not available, remove the electrode and lay the insulated holder on the deck or other adjacent object.

6. **Damp Clothing; Bare Skin.** Never permit the metal part of an electrode holder to touch either the bare skin or any damp clothing which the operator may be wearing. This is almost certain to result in fatal shock.

1037. CABLE AND COUPLINGS

1. **Type.** Only approved welding cables of the completely insulated flexible type conforming to specification MIL-C-915 shall be used. They shall be capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the welding operator is working. No splices shall be permitted within a distance of 10 feet from the electrode holder.

2. **Connectors and Couplings.** When it becomes necessary to connect lengths of cable, substantial insulated connectors of a capacity at least equivalent to that of the cable shall be used. Fully insulated "rapid couplings" are carried in standard stock and should be used whenever possible. If connections are effected by means of cable lugs, the lugs shall be soldered to the cable and securely fastened together to give good electrical contact. The exposed metal parts of the lugs, and the means used to fasten them together, shall be completely covered with rubber tape and protected with friction tape or equivalent protective covering. If any part of the connection is left bare, accidental contact with a metallic structure may cause sparks, arcs, and fires.

3. **Inspection.** Cables should be inspected once a month to see that they are in good condition.

4. **Bare Conductors.** When a cable (either work lead or electrode lead) becomes worn, exposing bare conductors, the exposed portion shall be protected by means of rubber and friction tapes or equivalent protection.

5. **Keep Cables Dry and Free of Oil.** Welding cables should be kept dry where practicable, and free from grease and oil, to prevent premature breakdown of the insulation.

6. **Transporting Cables.** When it becomes necessary to carry cables some distance from the machines, they should be substantially supported overhead, if practicable. If this cannot be done, and cables are laid on floor or ground, they should be protected in such a manner that they will not incur damage or interfere with safe passage of personnel. Special care should be taken to see that welding supply cables are not in proximity to power supply cables or high-tension wires.

7. **Looping Cable Over Shoulder.** Do not loop the welding cable over the shoulder (particularly over the shoulder opposite the hand holding the electrode holder). There is no shock hazard in this practice as long as the cable has no breaks, but operators have been dragged off staging or scaffolds when the cables were fouled by cranes, etc.

8. **Separation of Cables.** When using portable machines, care should be taken to

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see that the power supply cables are separately laid and do not become entangled with welding supply cable.

1038. GROUND RETURNS

1. **Frame Grounded.** Before starting operations, the operator shall make certain that the welding machine frame is grounded, that neither terminal of the welding generator is bonded to the frame of the welding machines, and that all electrical connections are securely made. The ground connection should be attached firmly to the work, not merely laid loosely upon it.

2. **Use of Structure or Pipe Line.** Ground returns from the work to the machine should be made with a cable wherever practicable. However, under some operating conditions it may be necessary to utilize a structure or pipe line for the ground return. When such a structure is employed precautions against the creation of unsafe conditions must be taken.

3. **Flammable Liquid Pipe Lines.** Pipe lines carrying gases or flammable liquids shall not be used for a ground return circuit.

4. **Contact at Joints.** When a structure or pipe line is used as a ground return circuit, it shall be checked to ascertain whether proper electrical contact exists at all joints. A condition of sparking or heating at any point should cause the rejection of the structure as a ground circuit, particularly if flammable vapors or gases may be present.

5. **Avoid Current Through Bearings.** Ground connection must be made in front of any bearings or similar joints in a structure or machine. Welding current going to ground through a bearing will almost invariably cause sparking and heating which will pit and ruin ball and roller bearings or other polished surfaces.

6. **Joints Bonded and Inspected.** Where a structure or pipe line is continuously employed as a ground return circuit, all joints shall be bonded and appropriate periodic inspection shall be conducted to ascertain that no condition of electrolysis or fire hazard exists as a result of such use.

7. **Inspection.** All ground connections shall be checked to determine that they are mechanically strong and electrically adequate for the required current.

1039. INERT-GAS METAL-ARC WELDING

The hazards related to inert-gas metal-arc welding processes are brought about principally by the generation of exceptionally high intensity of radiant energy as compared to ordinary shielded metal-arc welding. The inert gas shield around the arc combined with the higher current densities required results in an ultraviolet radiation intensity 5 to 35 times greater and 1½ times more infrared radiation. Such high intensities, particularly of ultraviolet radiation, introduce more severe problems with respect to eye and skin protection and to the conversion of oxygen to ozone, nitrogen to its oxides, carbon dioxide to carbon monoxide, and chlorinated solvents to irritating and toxic decomposition products. With the exception of chlorinated solvents, these by-products are not considered to be a problem under unconfined welding conditions with good natural ventilation. The requirements for control of toxic flux and metal fumes are not considered to be substantially different from those of any other welding process; appropriate precautions are equally applicable. The following precautions are particularly applicable to inert-gas metal-arc welding.

1. **Chlorinated Solvents.** Radiation from the arc causes instantaneous decomposition of chlorinated solvents, such as perchloroethylene, trichloroethylene, and methyl chloroform, into highly toxic phosgene gas and other irritating products. Inert-gas welding should not be permitted in the vicinity of degreasers or other sources of chlorinated solvent vapors. Decomposition of the vapors is usually accompanied by a characteristic, irritating, objectionable odor which may serve as an adequate warning. Since the argon gas shielded arc yields greater radiation intensity than helium shielded arcs,

1822

MT-PWHD-005428

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REDACTED
J-M 83

much more decomposition occurs when argon is used.

2. Screening. The welding operation shall be shielded with a fire resistant screen to protect those not directly involved in the operation from radiation injury to the skin or eyes.

3. Protective Clothing. Welding operators, helpers, and others working inside the screened area should wear protective clothing sufficient to completely cover the body leaving no areas of bare skin. Leather or woolen clothing is preferable since cotton outergarments deteriorate upon exposure to the high intensity ultraviolet radiation. Any exposed areas should be observed for reddening of the skin so that early remedial action can be taken.

4. Eye Protection. As with any other kind of arc welding, flash goggles shall be worn under the welding or hand-held shield. Since visible light as well as total radiation is increased in this type of welding, helmet filter plates should be of the deepest shade that permits adequate visibility of the welding operation. It may be necessary to exceed the shades recommended in article 1011.6 in order to provide adequate protection.

WELDING IN CONFINED SPACES

1045. HAZARDS OF INADEQUATE VENTILATION

Under conditions of improper ventilation, welding operations may create health hazards. These hazards are almost entirely due to:

1. the presence of gases, dusts, and fumes containing lead, zinc, cadmium, fluorine, or compounds thereof (see article 1012 and Chapter 20);
2. the possible formation of oxides of nitrogen;
3. extreme heat.

1046. VENTILATION REQUIRED

When any of the above hazards are present, adequate forced ventilation shall be provided and/or an individual air respirator shall be worn by the operator (see article 1012).

1047. VARIABLES AFFECTING VENTILATION

Attention is invited to the variables listed below which must be evaluated for their effect on calculations of minimum forced general ventilation requirements for spaces regularly used for welding operations:

1. dimensions of space, with special regard to height of ceiling;
2. type of welding (gas, arc, inert-gas shielded);
3. number of operators (gas or electric);
4. composition and coatings of metals to be welded and of fluxes to be used;
5. type and size of electrodes, and amperage used;
6. rate of welding;
7. variations in "natural" ventilation due to weather conditions;
8. path of forced and convection currents and stratification at working level;
9. tendency of fumes to form flocculent dust;
10. accident hazards involved in reduced visibility;
11. excessive deposits of fume-dust on other shop equipment;
12. excessive heat generated by gas and electric arc welding.

1048. SPACE CLASSIFICATION

Three space classifications have been adopted for convenience in setting ventilation standards, as follows:

Class I: Spaces of 50,000 cubit feet and over

Class II: Spaces of 5,000 to 50,000 cubic feet

Class III: Spaces under 5,000 cubic feet

1823

MT-PWHD-005429

REDACTED
J-M 83

1049. WHERE POSITIVE VENTILATION NOT REQUIRED

1. **Outdoor Welding Operations.** For welding operations on uncoated ferrous metals conducted in the open air, positive ventilating devices or respiratory protective equipment are not required. However, where an operator is engaged in welding or cutting lead-bearing steels, lead or cadmium-bearing paint, whether indoors or out, an air-line mask or local exhaust ventilation shall be used. Where conditions do not permit their use, a filter-type respirator, approved for protection from lead fumes, may be used, but only for short intermittent periods of work.

2. **Class I Spaces.** Where welding of uncoated ferrous metals is the largest proportion of the work carried on in spaces over 50,000 cu. ft., positive ventilation is *not* required for the protection of welders *provided:*

a. welding bays are not structurally blocked, thereby obstructing cross ventilation;

b. no welding operations are on the inside of tanks, boilers, or other closed iron or steel containers;

c. a space allowance of 10,000 cubic feet is assured each operator.

1050. INDIVIDUAL VENTILATION DEVICES

1. **Exhaust Ducts.** Where welding of uncoated ferrous metals is the largest proportion of the work carried on, an individual positive ventilation device for each operator shall be so designed and installed as to remove toxic fumes and dust at their source. This ventilation may be in the form of individual portable exhaust pipes, exhaust ducts from a central duct system, wall or roof fans, or any other equivalent means which will insure fume removal or dilution.

2. **Toxic Exhaust Fumes.** All ventilating devices installed, particularly portable temporary devices, shall be carefully scrutinized to insure that fumes, dust, etc., are not being exhausted into the same space or into other spaces, thus creating unrecognized hazards. Steps shall also be taken to insure that air replacing that withdrawn is clean and respirable.

3. **Hood Devices or Hose-Nozzles.** The effectiveness of either a hood device or hose-nozzle in removing fumes at their source depends upon the nearness of the intake openings to the welding operation. In the following table, which sets the minimum air-flow standards for removal of welding fumes, dusts, and gases at their point of origin, allowance is made for variables in the welding zone services, ranging from below 8 inches up to 15 inches from the arc or torch to the exhaust intake:

Individual Positive Ventilation Devices For Indoor Welding
(on uncoated ferrous metals)

Welding zone distance to exhaust intake from arc or torch.	Class I 50,000 cu. ft. or over	Class II 5,000 to 50,000 cu. ft.	Class III under 5,000 cu. ft.
	Minimum air flow per operator—cu. ft. per minute		
Up to 8 inches	200	225	250
8 to 10 inches	250	275	300
10 to 12 inches	300	350	375
12 to 15 inches	350	400	450

1051. GENERAL SHOP OR SPACE VENTILATION

1. **Wall or Roof Fans.** During welding of uncoated ferrous metals in confined spaces where individual ventilating devices are unavailable, a fan or fans (wall or roof) or other positive ventilating device shall be installed to insure fume dilution and general space ventilation at the following minimum air flow rate:

MT-PWHD-005430

0008 1113 REDACTED J-M 83

General Shop Ventilation, Welding Uncoated Ferrous Metals

Space	Minimum air flow cubic feet per minute per operator	OR Complete air change[1] each
Class I	350	20 minutes.
Class II	350	15 minutes.
Class III[2] *(space per operator)*		
4–5,000 cu. ft.		4 minutes.
3–4,000 cu. ft.		3 minutes.
2–3,000 cu. ft.		2 minutes.
Less than 2,000		1 minute.

[1]The volume of the space divided by the cfm. capacity of the blower, equals the theoretical time to change the air once.

[2]At least 1,000 cubic feet as well as the indicated space ventilation should be assured each operator.

2. **Fan Efficiency.** Particular attention is called to the necessity for selecting a type of fan capable of developing the required air volumes and pressure against the resistance of the exhaust system.

3. **Screened Spaces.** When electric welding must be performed in a space entirely screened on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. It is desirable to have the screens mounted on end posts so that their bottom edges are about two feet above the floor unless the work is performed at so low a level that the screen must be extended nearer the floor to protect nearby workers from welding glare. In the latter case the screens must clear the deck by several inches.

1052. INDOOR WELDING OF GALVANIZED IRON OR STEEL, BRASS OR BRONZE

1. **Frequently and Regularly**

a. **Class I Spaces.** The forced general ventilation prescribed in article 1051 shall be increased by at least 10 percent; or the individual ventilation devices prescribed in paragraph 1050.3 shall be used.

b. **Class II and III Spaces.** Individual ventilating devices prescribed in the table in paragraph 1050.3 shall be provided. General shop ventilation standards are insufficient to protect the operator from the fumes of these metals.

2. **Infrequently and Irregularly (Class I, II, and III spaces).** If these spaces are not already provided with the degree of ventilation prescribed in 1(a) above, it will be satisfactory to provide each welder working on galvanized iron or steel, brass, or bronze, with a portable individual ventilating device for use while such operations are being performed.

3. **Inside Tanks or Closed Containers.** When welding on galvanized iron or steel, brass, or bronze, inside tanks or other closed containers, the operator shall be furnished an approved type of airline respirator or hose mask, and its use shall be strictly enforced.

1053. EXPLOSIVE FUMES

1. **Dangers.** It must be borne in mind that certain gas and air mixtures such as acetylene and oxygen may accumulate in concentrations which are not toxic but may be explosive. The required ventilation shall be governed by the more dangerous condition.

2. **Exhaust to Atmosphere.** Utmost care shall be taken that the exhausted vapors are not allowed to discharge into any other compartment or area. Exhaust shall be only to the outside atmosphere. Openings in the vicinity of the exhaust shall be closed to keep vapors from drifting into other areas.

3. **Do Not Use Oxygen.** When forced ventilation of a space is required or used, it should *not* be accomplished by injecting oxygen in lieu of fresh air. Such a procedure is likely to raise the oxygen concentration of the air in the space and substantially change the flammability limits.

1825

MT-PWHD-005431

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4. Flame Arresters. Wire-gauze flame arresters shall be in place on tank vents used for exhaust outlets, and similar flame arresters shall be provided at the outboard ends of temporary exhaust tubes.

5. Blowers. If weather conditions are such that the exhausted vapors will not be quickly dissipated, air-motor-driven blowers or those driven by explosion-proof electric motors should be used to assist in their dispersal. Electric blowers not equipped with explosion-proof motors shall not be used. If blowers are not used in quiet, humid weather, it is possible for a stream of explosive vapor to drift several hundred yards to a source of ignition, from which a flame will flash back to the source of the vapors.

1054. CERTIFICATION OF CLOSED COMPARTMENTS.

No person shall enter and no work shall be permitted in any closed compartment or poorly ventilated space in any shore activity or in any Navy ships or boats under construction or repair until a certificate has been issued by the safety engineer or his authorized representative certifying that the space is safe for men and safe for type of work intended. The procedures and requirements for issuance of such certificates are provided in article 2071.

MT-PWHD-005432

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J-M 83



0008 1116 REDACTED J-M 83

Chapter 11

WOODWORKING

1101. APPLICATION AND SCOPE

1. **Applicability.** These safety precautions shall apply to all woodworking machinery and equipment used ashore and afloat. The provisions of American Standard safety codes shall be used insofar as they may be applicable as guides in securing the correction of hazards or hazardous conditions not specifically covered herein.

2. **Other Machines Not Excluded.** The mention of specific machines is not intended to exclude other woodworking machines from the requirement that suitable guards and exhaust hoods be provided to reduce the operational hazards. The absence of a safety precautionary measure covering any specific equipment, operation, or hazard does not relieve management from the responsibility of providing reasonable safety measures.

1102. INSTRUCTION OF PERSONNEL

1. **Experienced Operators.** No person shall be permitted to operate any woodworking machinery until he has been instructed as to the hazards and the proper operation of such equipment and the use of protective devices.

2. **Sharpening Saws.** No workman shall attempt to file or sharpen a saw unless he is qualified and has been properly authorized to perform such work.

3. **Guards.** Guards shall be installed wherever possible and their use explained and enforced. If special operations and the making of repairs or adjustments require the removal of the guard, it shall be immediately replaced upon completion of the work which required its removal. No person shall be permitted to remove a guard or to operate the machine without the guard except with the consent of his supervisor.

1103. WORKING AREAS

1. **Floors.** All floors shall be kept in good repair and shall be free from protruding nails, splinters, holes, unevenness, and loose boards. Effective means shall be provided to prevent slipping.

2. **Aisles.** Aisles shall be of sufficient width to permit the uncrowded and safe passing of personnel, trucks, or material. Where practicable, lines shall be painted on the floor or some similar method shall be employed to mark aisles.

3. **Illumination.** During all working periods each working area, operation, or process shall be adequately lighted and harmful glare minimized. The illumination shall not be less than the minimum foot-candles given in the following table:

Minimum Foot Candles in Service

Representative activity	*Foot-candles*
Rough sawing and bench work	30
Sizing, planing, rough sanding, medium machine and bench work, gluing	50
Fine bench and machine work, fine sanding and finishing	100

For activities and locations not included in the above list, see the recommended levels tabulated in article 0213.4.

1104. DEFECTIVE EQUIPMENT

1. **Hazardous Defects.** Tools, machines, devices, or other equipment that are hazardous because of defects or other conditions shall not be used until suitably repaired. All cracked saws shall be removed from service.

2. **Wedges.** The practice of inserting wedges between the saw disk and the collar

1828

MT-PWHD-005434

0008 1117 REDACTED J-M 83

to form what is commonly known as a "wobble saw" shall not be permitted.

3. Saw Defects. Dull, badly set, improperly filed, or improperly tensioned saws, shall be immediately removed from service as soon as they begin to cause the material to stick, jam, or kick back when it is fed to the saw at normal speed. A saw to which gum has adhered shall be immediately cleaned.

1105. CARE OF EQUIPMENT

1. **Knives.** All knives and cutting heads shall be kept sharp, properly adjusted, and firmly secured. Where two or more knives are used in one head, they shall be properly balanced.

2. **Arbors.** Arbors of all circular saws shall be free from play.

3. **Bearings.** Bearings shall be kept free from excessive play and shall be kept well lubricated.

1106. SAFETY EQUIPMENT

1. **Push Stick.** A push stick made of a narrow strip of wood or similar material with a notch cut in one end and shaped on the other end to provide a good hand grip shall be used to push material through saws where there is possibility of the operator's fingers coming in contact with blades at point of operation.

2. **Push Block.** A push block of wood or similar material having a handle like a hand plane and a notch or shoulder at the rear end shall be used to push short stock over the jointer knives.

3. **Jig.** A jig or fixture shall be used when cutting or forming irregular pieces or oblique angles.

4. **Fillister.** When narrow strips are cut a fillister piece about 2 inches wide shall be used between the fence or gage and the material being cut. It shall be firmly secured to the table or to the fence by cleats, clamps, or other effective means.

5. **Guards for Moving Parts.** Adequate safeguards shall be provided for all moving parts of equipment used in the mechanical transmission of power, including prime movers and intermediate equipment. Driven machines, such as engines, motors, connecting rods, cranks, fly wheels, shafting, spindles, pulleys, belts, link belts, chain, ropes, rope drives, gears, sprockets, friction drums, cams, couplings, clutches, counterweights, revolving or reciprocating parts shall also be guarded, up to the point of operation.

6. **Guards for Projections.** All projecting keys, setscrews, and other projections in revolving parts shall be made flush or guarded by a substantial metal cover. This does not apply to keys or setscrews within a gear pulley or sprocket casting or other enclosure; nor to keys, setscrews or oil cups in hubs of pulleys less than 20 inches in diameter where they are within the plane of the rim of a pulley.

7. **Exhaust Hoods.** All power saws shall be guarded underneath and behind the table to prevent possible personal contact. Exhaust hoods will be considered as adequate underneath or rear guards.

8. **Power Cut-Off.** A mechanical or electrical power control shall be provided on each machine which will make it possible for the operator to cut off the power from the machine being operated without leaving his position at the point of operation.

9. **Belt Shifter.** In machines driven by belts and shafting, a locking-type belt shifter or an equivalent positioning device shall be used.

1107. DUST CONTROL

1. **Requirements.** Each activity containing 4 or more woodworking machines whose operations create dust, shavings, chips, or slivers shall be equipped with an exhaust system either continuous or automatic in action, of sufficient strength and capacity to remove such refuse from the points of operation and immediate vicinities of machine and work places.

1823

MT-PWHD-005435

0008 1118

REDACTED
J-M 83

2. **Size.** All exhaust pipes or ducts shall be of such size as to minimize the possibility of clogging. They shall be readily accessible for cleaning. All exhaust pipes or ducts shall empty into dust-tight settling chambers so constructed that dust cannot be discharged into adjoining areas.

3. **Fire Prevention.** The settling or dust chamber shall be of fire-resistant construction and shall be so designed and operated as to reduce to a minimum the danger of dust explosions. The volume of accumulated refuse shall be held to a practical minimum.

1108. HEARING PROTECTION

Operators of woodworking machines and those within the immediate vicinity shall wear ear protective devices whenever the noise generated by the machines has reached a level injurious to the hearing of the workmen (see BuMed Instruction 6260.6A).

WOODWORKING MACHINES

1110. CIRCULAR SAWS

1. **Operating Precautions**

a. Choice of Saw. Do not use a ripsaw for cross-cutting or cross-cut saws for ripping. Cross-cut saws can be used for ripping but they are not intended for such work and should not be so used.

b. Condition of Saw. See that saw is in good condition before starting to use it. This means sharp, unbroken, and free from cracks. The blade shall be changed if dull, cracked, chipped, or warped.

c. Setting. Be sure saw is set at proper height above the table to cut through the wood.

d. Kickbacks. Avoid "kickbacks" by standing to one side of the saw—not in line with it.

e. Push Stick. Always use a push stick to push short narrow pieces between the saw and the gage.

f. Debris. Keep material of any kind from accumulating on the saw table.

g. Reaching. Never reach over saw to obtain material from the other side.

h. Feeding. When cutting, do not feed wood to saw faster than the saw will cut freely and cleanly.

i. Attention. Never leave the sawing machine unattended with the power turned on.

2. **Speed.** Circular saws shall not be operated at speed in excess of 10,000 peripheral feet per minute. Saws tensioned for higher speeds shall be etched by the manufacturer to indicate the maximum operating speed. These etched speeds shall not be exceeded.

The following table shows revolutions per minute for various diameters of saws with the peripheral speed of 10,000 feet per minute:

Diameter of saw (inches)	*R.P.M.*	*Diameter of saw (inches)*	*R.P.M.*
8	4,774	20	1,910
10	3,819	22	1,736
12	3,183	24	1,529
14	2,728	26	1,469
16	2,387	28	1,364
18	2,122	30	1,273

3. **Hand-Fed Ripsaws**

a. Hoods. Each circular hand-fed ripsaw shall be guarded by a hood which shall completely enclose that portion of the saw above the table. The hood and mounting shall be so arranged that the hood will automatically adjust itself to the thickness of, and remain in contact with the material being cut. The hood shall be of adequate strength to resist blows and strains incidental to reasonable operation, adjusting and handling, and shall be so designed as to protect the operator from flying splinters and broken saw teeth. The hood shall be so mounted as to insure its operation to be positive, reliable, and in true alignment with the saw; and the

1330

MT-PWHD-005436

0008 1119 REDACTED J-M 83

mounting shall be adequate in strength to resist any reasonable side thrust or other forces tending to throw it out of line.

b. Spreaders. Each hand-fed circular ripsaw shall be furnished with a spreader to prevent material from squeezing the saw or being thrown back on the operator. The spreader shall be made of saw steel or tool steel which has been hardened, tempered, and ground to gage so that it is thinner than the saw kerf but thicker than the saw blade. It shall be of sufficient width to provide adequate stiffness or rigidity to resist any reasonable side thrust or blow tending to bend or throw it out of position. The spreader shall be so attached as to remain in true alignment with the saw even when either the saw or table is tilted, and shall be so placed that there is not more than ½ inch space between the spreader and the back of the saw when the largest saw is mounted in the machine.

The provision of a spreader in connection with grooving, dadoing, or rabbeting is not required. On the completion of such operations, the spreader shall be immediately replaced.

c. Nonkickback Finger or Dog. Each hand-fed circular ripsaw shall be provided with one or more nonkickback fingers or dogs mounted on the hood and so located as to oppose the thrust or tendency of the saw to pick up the material or to throw it back toward the operator. They shall be designed to provide adequate holding power for all thicknesses of materials being cut.

4. Hand-Fed Crosscut Table Saws (Including Trimmer Saws). Each circular crosscut table saw shall be guarded by a hood which shall meet all the established requirements.

5. Swing and Sliding Cut-Off Saws

a. Hood Necessary. Each swing or sliding cut-off saw shall be provided with a hood that will completely enclose the upper half of the saw, the arbor end, and the point of operation at all positions of the saw. The hood shall be constructed in such a manner, and of such material, that it will protect the operator from flying splinters and broken saw teeth and will afford the operator a clear view of the cutting edge of the saw at all times.

b. Hinged Hoods. The hood shall be hinged at the back and provided with an extension at the front so that when the saw is returned to the back of the table, the hood will rise on top of the fence; and when the saw is moved forward, the hood will drop on the top of, and remain in contact with, the material being cut.

c. Saw Tables. Each swing and sliding cut-off saw table shall be extended at the point of operation wide enough to maintain table surface below the exposed edge of the saw blade to the full extent of the travel of the saw.

d. Counterweights. Each swing cut-off saw shall be provided with an effective device to return the saw automatically to the back of the table when released at any point of its travel. Such device shall not depend for its proper function upon any rope, cord, or spring. If there is a counterweight, the bolts supporting the bar and counterweight shall be provided with cotter pins. The counterweight shall be prevented from dropping by either a bolt passing through both the bar and counterweight, or a bolt put through the extreme end of the bar. Where the counterweight does not encircle the bar, a safety chain should be attached to it.

e. Limit Stops. Each swing cut-off saw shall be provided with limit chains or other equally effective device to prevent the saw from swinging beyond a front or back position where the gullets of the lowest teeth will rise above the table top.

6. Inverted Swing Cut-Off Saws. Inverted swing cut-off saws shall be provided with a hood that will cover the part of the saw that protrudes above the top of the table or above the material being cut. It shall automatically adjust itself to the thickness of, and remain in contact with, the material being cut.

7. Revolving Double Arbor Saws. Revolving double arbor saws shall be fully

1831

MT-PWHD-005437

0008 1120 REDACTED J-M 83

guarded in accordance with all of the requirements for circular crosscut saws or with all of the requirements for circular ripsaws.

8. Circular Resaws

a. Shields. Each circular resaw shall be guarded by a hood or shield of metal above the saw. Such hood or shield shall be so designed as to guard against danger from flying splinters or broken saw teeth.

b. Spreader. Each circular resaw (other than self-feed saws with a roller or wheel at back of the saw) shall be provided with a spreader fastened securely behind the saw. The spreader shall be slightly thinner than the saw kerf and slightly thicker than the saw disk.

9. Self-Feed Circular Saws

a. Hoods. Feed rolls and saws shall be protected by a hood or by semicylindrical guards to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be constructed of heavy material, preferably metal, and the bottom of the guard shall come down to within 3/8 inch of the plane formed by the bottom of working surface of the feed rolls.

b. Nonkickback Fingers. Each self-feed circular ripsaw shall be provided with sectional nonkickback fingers for the full width of the feed rolls. They shall be located in front of the saw.

10. Portable Circular Saws

a. Guards. All portable, power-driven saws shall be equipped with guards which will automatically adjust themselves to the work when in use, so that none of the teeth protrude above the work. The guard over the blade shall be adjusted so that it slides out of its recess and covers the blade to the depth of the teeth when the saw is lifted off the work.

b. Face Protection. Goggles or face-shields shall be worn while using the saw and while cleaning up debris afterward.

c. Grasp Saw Firmly. Saws are to be grasped with both hands and held firmly against the work. Care shall be taken that the saw does not break away, thereby causing injury.

d. Inspection of Blade. The blade shall be inspected at frequent intervals and always after it has locked, pinched, or burned. The electrical connection shall be broken before this examination.

e. Overloading Motor. The saw motor shall not be overloaded by pushing too hard or cutting stock that is too heavy.

f. Examination of Material. Before using the saw, the material to be cut shall be carefully examined and freed of nails or other metal substances. Cutting into or through knots shall be avoided as far as possible.

g. Making Repairs. The electric plug shall be pulled before any adjustments or repairs are made to the saw. This includes changing the blade.

1111. BAND SAWS

1. General

a. Testing for Defects. Band saw wheels should be tested by experienced men at least once a week with a small machinist's hammer to detect cracks or loose spokes. The sound of a cracked or broken wheel is dull and flat.

b. Cracked Blade. Cracked blades should not be used. If a blade develops a "click" as it passes through the work, the operator should shut off the power as the click is a signal that the blade is cracked and may be ready to break. After the saw blade has stopped moving, it should be replaced with one in proper condition.

c. Broken Blade. If the saw blade breaks, the operator should shut off the power, and not attempt to remove any part of the saw blade until the machine is completely stopped.

d. Free Working Blade. If the work binds or pinches on the blade, the operator should never attempt to back the work away from the blade while the saw is in motion since this may break the blade. He should always see that the blade is working relatively freely through the cut.

e. Danger From Cold. A band saw preferably should not be operated in a location where the temperature is below 45 de-

1832

MT-PWHD-005438

0008 1121

REDACTED
J-M 83

grees Fahrenheit as it may break when the machine is started.

f. Size of Saw. Using a small saw for large work or forcing a wide saw on a small radius is bad practice. The saw blade should in all cases be as wide as the nature of the work will permit.

g. Stopping Saw. Band saws should not be stopped by thrusting a piece of wood against the cutting edge or side of the band saw immediately after the power has been shut off because the blade may break. Band saws 36 inches and larger shall have a hand or foot brake.

h. Brazing. Particular care should be taken when sharpening or brazing a band saw blade to see that the blade is not overheated and that the brazed joints are thoroughly united and are finished to the same thickness as the rest of the blade. It is recommended that all band saw blades be butt welded where possible, as this method is much superior to the old style of brazing.

2. Band Saws and Band Resaws

a. Enclosing Blade. All portions of the saw blade shall be enclosed or guarded, except the working side of the blade between the guide rolls and the table. Band-saw wheels shall be fully encased.

b. Guards. The outside periphery of the enclosure shall be solid. The front and back of the band wheels shall be enclosed by solid material, sheet metal or casting, or perforated metal. The sheet metal is to be not less than 0.037 inches (U.S. Gage No. 20). The guard for the portion of the blade between the sliding guide and the upper-saw-wheel guard shall enclose the saw blade on all sides. This portion of the guard shall be self-adjusting to raise and lower with the guide. The upper wheel guard shall be made to conform to the travel of the saw on the wheel and the top member of the guard shall have at least a 2-inch clearance outside the saw.

c. Automatic Tension. Each band-saw machine shall be provided with an automatic tension control device to prevent breakage of saw blades due to improper tension.

d. Feed Rolls. Feed rolls of band resaws shall be protected with a semicylindrical guard to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be constructed of heavy material, preferably metal, and the edge of the guard shall come to within 3/8 inch of the plane formed by the inside face of the feed roll in contact with the stock being cut.

1112. SHAPERS

1. Inspection. Shapers shall be inspected before use. They shall be free of cracks and dirt, and shall be sharp.

2. Removing Blades. When one blade is removed from a shaper spindle for sharpening or for some other purpose, all other blades should be removed at the same time. This is in case the machine is started accidentally.

3. Starting and Stopping Device. All double-spindle shapers shall be provided with a spindle starting and stopping device for each spindle. All shapers shall be provided with an automatic brake to stop the revolving heads as soon as possible after the power is shut off.

4. Cleaning and Repairing. The power shall be turned off and the steps taken to insure that it will not be turned on before the cleaning, adjusting, or repairing of the shaper is completed.

5. Speed. The correct speed shall be used while shaping. This may vary with the type of cutter or material. The supervisor shall be consulted in case of doubt.

6. Table Guide. When a table guide is used, the operator should be sure that it is well fastened and will not slip.

7. Knives

Solid cutters which fit over the spindle shall be used as standard practice. When it is necessary to use knives the following precautions shall apply:

a. Knife blades and collars for shaper heads shall be precision ground so as to

1833

MT-PWHD-005439

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give uniform pressure on all knife blades and keep them from flying out while the machine is in motion.

b. Collars shall be provided with "stop pins" and knife blades shall have a recess cut in them for the pin as an added precaution to keep the blades from flying out.

c. Only sharp knives of the same bevel and balance, free of burrs or other imperfections shall be used.

d. Short knives shall not be used. A knife shall not be used after its length has been shortened to the extent that the butt end does not extend beyond the middle point of the collar.

e. Before tightening the knives in place the operator shall make sure the collar surfaces are free of burrs or foreign material which will prevent the knives from having an adequate bearing.

8. **Cutting Techniques**

a. Operators should not "back up" on a cut. Running material in the direction of rotation of the spindle, instead of against it, is dangerous.

b. Operators should avoid taking deep cuts or feeding the stock too rapidly or with too great pressure.

9. **Machining Wood.** Operators should be particularly careful in machining wood that contains cross grains or knots, as these may cause the hands to be thrown into the knives or cause kickbacks.

10. **Protection of Hands.** Operators should not rest their hands near edge of material being cut.

11. **Protection of Face.** Goggles or face-shield shall be worn while shaping.

12. **Guards.** The cutting heads of each wood shaper, hand-fed panel raiser, or other similar machine not automatically fed shall be enclosed with a cage or adjustable guard so designed as to keep the operator's hands away from the cutting edge. The diameter of circular shaper guards shall be not less than the greatest diameter of the cutter. In no case shall a warning device of leather or other material attached to the spindle be acceptable.

13. **Cylindrical Heads.** Cylindrical heads should be used wherever the nature of the work will permit. Templates, jigs, and fixtures which will remove the operator's hands from the point of operation should be used wherever the nature of the work will permit.

14. **Kickback.** A kickback preventer should be used when possible.

1113. TENONING MACHINES

1. **Guards.** Each tenoning machine shall have all cutting heads, and saws if used, covered by metal guards. These guards shall cover at least the unused part of the periphery of the cutting head. If such guard is constructed of sheet metal, the material used shall be not less than 1/16 inch in thickness, and if cast iron is used, it shall be not less than 3/16 inch in thickness.

2. **Exhaust Hood.** Where an exhaust system is used, the guard shall form part or all of the exhaust hood and shall be constructed of a metal of a thickness not less than the above.

3. **Feed Chains and Sprockets.** Feed chains and sprockets of all tenoning machines shall be completely enclosed, except that portion of chain used for conveying the stock. At rear ends of frames over which feed conveyors run, sprockets and chains shall be guarded at sides by plates projecting beyond periphery of sprockets and ends of lugs.

1114. JOINTERS

1. **Knives**

a. Only sharp and evenly balanced knives should be used in a jointer cutting head.

b. The knives must not be set to take too heavy a cut, as a kickback is almost certain to result especially if there is a knot or change of grain in the stock.

c. The knives must be securely fastened after the machine has been standing in a cold building over the weekend.

MT-PWHD-005440

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J-M 83

2. **Push Block.** When pieces shorter than 18 inches are machined, a push block should be used.

3. **Point of Operation.** Each hand-fed planer and jointer with horizontal head shall be equipped with a cylindrical cutting head, the throat of which shall not exceed 7/16 inch in depth nor 5/8 inch in width. It is strongly recommended that no cylinder be used in which the throat exceeds 3/8 inch in depth or 1/2 inch in width.

4. **Automatic Guards.** Each hand-fed jointer with a horizontal cutting head shall have an automatic guard which will cover all the section of the head on the working side of the fence or gage. The guard shall automatically adjust horizontally for edge jointing and vertically for surface work, and shall remain in contact with the material at all times.

5. **Horizontal Head Jointer.** Each hand-fed jointer with horizontal cutting head shall have a guard which will cover the section of the head back of the gage or fence.

6. **Vertical Head Jointers.** Each wood jointer with vertical head shall have either an exhaust hood or other guard so arranged as to enclose completely the revolving head, except a slot of such width as may be necessary and convenient for the application of the material to be jointed.

1115. PLANING, MOLDING, STICKING, MATCHING MACHINES, AND PROFILE AND SWING HEAD LATHES

1. **Guarding of Cutting Heads.** Each planing, molding, sticking, and matching machine, and profile and swing head lathe, shall have all cutting heads, and saws if used, covered by a metal guard. If such guard is constructed of sheet metal, the material used shall not be less than 1/16 inch in thickness; and if cast iron is used, it shall be not less than 3/16 inch in thickness.

2. **Exhaust Hoods.** Where an exhaust system is used, the guards shall form part or all of the exhaust hood and shall be constructed of metal of a thickness not less than the above.

3. **Feed Rolls.** Feed rolls shall be guarded by hood or a semicylindrical guard to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be fastened to the frame carrying the rolls so as to remain in adjustment for any thickness of the stock.

4. **Sectional Feed Rolls.** Sectional feed rolls shall be provided for planers. Where solid feed rolls are used, the sectional finger devices shall be used to prevent kickbacks.

1116. HAND PLANES AND DRAW KNIVES

1. **Choice of Tool.** Care shall be used in selecting the correct plane or draw knife for the work to be done.

2. **Firmly Clamped.** Wherever possible, the work shall be held firmly in a clamp or vise.

3. **Depth of Cut.** The plane blade shall be properly adjusted, as too deep a cut will cause the plane to buck and clog.

4. **Firmly Grasped.** The plane or draw knife shall be grasped with both hands.

5. **Bracing with Knees Prohibited.** No one shall use a draw knife while using the knees to brace the material.

6. **Protecting Blade.** To avoid possible injury to the hands when reaching for other tools, planes and draw knives shall be put away in such a manner that the blades will be protected.

1117. BORING AND MORTISING MACHINES

1. **Chucks.** Safety-bit chucks with no projecting setscrews shall be used.

2. **Boring Bits.** Boring bits shall be provided with a guard that will enclose all portions of the bit and chuck above the material being worked.

3. **Chain Mortiser.** The top of the cutting chain and driving mechanism shall be enclosed.

1835

MT-PWHD-005441

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J-M 83

4. **Counterweights.** If there is a counterweight, one of the following, or equivalent means, shall be used to prevent its dropping:

a. it shall be bolted to the bar by means of a bolt passing through both bar and counterweight;

b. a bolt shall be put through the extreme end of the bar;

c. where the counterweight does not encircle the bar, a safety chain shall be attached to it; other types of counterweights shall be suspended by chain or wire rope and shall travel in a pipe or other suitable enclosure wherever they might fall and cause injury.

5. **Universal Joints.** Universal joints on spindles of boring machines shall be completely enclosed to prevent injury to operator.

6. **Guarding Operating Treadles.** All operating treadles shall be covered by an inverted U-shaped metal guard, fastened to the floor, of adequate size to prevent accidental tripping.

1118. SANDING MACHINES

1. **General**

a. **Inspection.** All sanders shall be carefully inspected before use. Sanding disks or belts shall not be used if they are frayed or cracked.

b. **Personnel Protection.**

(1) Goggles and respirators shall be used during the sanding operations and while cleaning up afterward.

(2) The hands or other parts of the body shall be kept from coming into contact with the abrasive surface of the sander.

c. **Grasping Sander Firmly.** Sanders are to be grasped with both hands and held firmly against the work. Care shall be taken that the sander does not break away, thereby causing injury or damage.

d. **Disconnecting.** The electric plug shall be pulled before sanding belts or disks are changed or before repairs or adjustments are made to the sander.

2. **Belt Sanding Machines.** Each belt sanding machine shall have both pulleys enclosed in such manner as to guard the points where the sanding belt runs onto the pulleys. The unused run of the sanding belt shall be enclosed.

Belt type sanders shall be adjusted to the proper tension.

1119. COMBINATION OR UNIVERSAL WOODWORKING MACHINES

1. **Guards.** For combination or universal woodworking machines, each point of operation of any tool shall be guarded as required for such tool in a separate machine. Such machines shall be provided with a separate starting and stopping device for each point of operation.

2. **Feed Rolls.** Feed rolls of self-feed sanding machines shall be protected with a semicylindrical guard to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be constructed of heavy material, preferably metal, and firmly secured to the frame carrying the rolls so as to remain in adjustment for any thickness of stock. The bottom of the guard shall come down to within 3/8 inch of a plane formed by the bottom or contact face of the feed roll where it touches the stock.

3. **Drum Sanding Machines.** Each drum sanding machine in a location where an exhaust system is required shall have an exhaust hood. If no exhaust system is required, another type of guard shall be used. Guards shall be so arranged as to enclose the revolving drum. However, in cases where the use of a table makes complete enclosure impracticable, the guard should be arranged so as to enclose as much of the disk as possible and still leave room for manipulation of the material to be finished.

4. **Disk Sanding Machines.** Each disk sanding machine shall have an exhaust hood or other guard which shall be arranged as described above.

1836

MT-PWHD-005442

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J-M 83

SAWMILLS

1125. HOUSEKEEPING

1. Tripping Hazard. Good housekeeping around a sawmill is very important. Many a man has tripped over the crop end of a board and has fallen into a saw.

2. Clear Area. Before starting to chop or saw a tree, workmen shall clear a working area around it and a path so that they can get away from the tree quickly when it begins to fall.

1126. PERSONNEL PROTECTION.

1. Sawmill Machinery. Loose clothing shall not be worn around a saw or any other piece of machinery at the sawmill. Gloves should *not* be worn while operating machinery.

2. When Handling Lumber. Workmen handling lumber shall wear heavy aprons, and leather gloves or other suitable hand protection.

3. Goggles. Goggles shall be worn while doing work where dust or flying chips are a hazard to the eyes.

4. Footwear. All workmen handling wood blocks, boards, bundles of shingles, etc., should wear safety shoes or safety-toe clips.

5. Hard Hats. Workmen required to work under crane or monorail tracks, or where materials stored overhead create a hazard, shall wear protective hard hats while so employed.

6. Carrying Cases. Sharp tools shall be transported in carrying cases, or with sheathes installed over the cutting edges.

1127. SAFE OPERATING PROCEDURES

1. Protection of Hands. When operating power saws, the hands should always be kept out of the line of saw travel.

2. During Stormy Weather. Work shall not be carried on out-of-doors during periods of high wind and storms of sufficient violence to endanger workmen, except in case of emergency.

3. Attaching Dogs. When attaching dogs to logs, care should be taken not to place the hand or fingers where they might be caught between the log and the dog.

4. Risk of Falling Lumber. Workmen shall not stand under lumber which is being moved.

5. Kickback. Workmen operating power feeds or other machines subject to kickback hazards shall not stand in line with the stock being fed into machine unless it is equipped with positive means of preventing kickbacks.

6. Portable Chain Saws. Workmen other than operators shall stand clear of portable chain saws they are operating.

7. Riding Sorting Chains. Workmen shall not ride moving sorting chains or similar equipment, except where it is necessary in the operation of grading, tallying, or straightening lumber.

8. Crossing Sorting Chains. Only workmen who work on sorting chains shall cross over those chains. Where provided, elevator crossovers shall be used.

1837

MT-PWHD-005443

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J-M 83



MT-PWHD-005444

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J-M 83

Chapter 12
PIPING AND PLUMBING; SEWAGE AND WATER TREATMENT

PIPING AND PLUMBING

1201. INTRODUCTION

1. **Minimum Requirements Code.** The approved safety and health requirements for design, installation, inspection and performance of modern plumbing equipment and systems ashore are contained in *Minimum Requirements for Plumbing,* American Society of Mechanical Engineers.

2. **Excavation Work.** Precautions to be observed by pipe fitters and plumbers when engaged in trench excavation work will be found in article 0887.

1202. WORK ON PIPING

1. **Acids.** Acids used should be kept in only glass or lead containers.

2. **Pouring Joints.** Care shall be exercised to keep out from under hot joints while they are being poured.

3. **Hot Lead.** Hot lead should not be poured over water or wet caulking.

4. **Oily Floors.** If floors are oily and cannot be kept dry, they should be covered with sand or oil-absorbent compound.

5. **Connections.** Any tee, valve, or other service connection which is to be used on piping in maintenance or repair operations should be very carefully checked to make sure that it is designed to withstand the maximum pressure that might be exerted on it.

1203. SEWER WORK

1. **Leaking Pipes.** Before plumbing work is started on sewer jobs, pits, or tanks where the hazard of broken or leaking pipes may be present, these two preparatory steps shall be taken:

a. **Protective Devices.** Gas detectors, respirators, inhalators, standard gas masks, safety belts, lifelines, and blowers shall be provided as needed.

b. **Testing.** Tests shall be made for explosive gas-air mixtures and oxygen deficiencies in these locations before personnel enter them.

2. **Control Measures.** Where such hazards are found to exist, adequate control measures will be instituted and workmen shall don suitable respiratory equipment as necessary, before entering the structure. Workmen should be instructed as to the kind of respirator to use in an emergency, and how to assemble and use this equipment properly. This information will be found in NAVEXOS P-422, *Safety Equipment Manual.*

3. **Two-Man Watch.** At least two men shall be assigned to each sewer job where the hazard of broken or leaking pipes may be present. One man shall always be in a relatively safe position and prepared to render assistance in an emergency.

4. **Removing Manhole Cover.** To help dissipate any toxic or flammable gas that may exist in a sewer or underground sewage pumping plant, the manhole cover should be removed several minutes before a workman descends.

1204. PROTECTIVE CLOTHING AND EQUIPMENT

1. **Clothing.** Goggles, gloves, and other protective clothing provided for personnel safety shall be worn in all pipe fitting, pipe handling, and plumbing work involving the pouring or handling of hot metal or acid, and in any other work where flying material might

MT-PWHD-005445

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J-M 83

injure the eyes. Goggles shall be worn when using compressed air to clean out sand, dirt, or scale from pipes before installation.

2. **Flameproof and Heatproof Garments.** Flameproof garments shall be worn when using blowtorches, welding torches, or similar tools. Plumbers should wear heavy coveralls and leggings which also cover the instep, as a protection against hot lead.

3. **Safety Belt.** When entering deep tanks, deep sewers, and other deep underground structures, a safety belt and lifeline shall be worn.

4. **Blowers.** Portable blowers are recommended for all tank, pit, or manhole work where there is any question as to the presence of noxious gases, vapors, or oxygen deficiency. These blowers should have vaporproof, totally enclosed motors or nonsparking gas engines, and when used they should be placed not less than 6 feet away from the opening and on the leeward side protected from wind, so that they will not serve as a source of ignition for any flammable gas which might be present.

1205. TOOLS–GENERAL

1. **Condition.** Tools and appliances shall be kept in good condition. Worn tools should be replaced. Check hammer handles frequently; hammers with broken or cracked handles shall not be used.

2. **Housekeeping.** Tools or materials shall not be allowed to clutter up the floor and become stumbling hazards. Pieces of scrap pipe should be picked up promptly and taken to the scrap bin or to the scrap tubs for the next scheduled pickup.

3. **Vise Jaws.** Vise jaws should grip the material securely. When threads are being cut, and during backing off operations, the stock should be held firmly.

4. **Protection of Threads.** Freshly cut threads should be protected with caps or couplings when possible. Care should be exercised to guard against sharp burrs or fins.

5. **Pipe Threading.** When operating a pipethreading machine, the clearance of the pipe shall always be ascertained before starting the machine.

6. **Molten-Lead Pot.** A cold ladle or other cold material shall never be dropped into a pot of molten lead, as an explosion may result.

1206. PIPE WRENCHES

1. **Clearance.** Care should be taken to assure that there is plenty of clearance in case the wrench should slip.

2. **Extension.** An extension should never be used on a pipe wrench, as it puts a strain on the wrench which it is not designed to take.

3. **Facing Forward.** An adjustable pipe wrench should always be faced forward in the direction the handle is to turn. When used that way adjustable wrenches can withstand the greatest force, because the pulling force is applied to the stationary jaw side of the handle.

4. **Bite.** The bite of an adjustable wrench should always be taken near the middle of the jaws, so that there will be teeth in front if the wrench slips.

5. **Strain.** Small wrenches should not be overstrained. Wrenches should not be subjected to a severe side strain, and they should never be used as hammers.

1207. HANDLING PIPE

1. **Gloves.** Workmen should wear leather or leather-faced gloves when handling pipe.

2. **Standing Clear.** Workmen should stand to one side when pipe is being unloaded from a truck or railway car.

3. **Piling Pipe.** Pipe should be piled so that the ends of the pipe will be even and not project into walkways. It should be stacked straight, that is, not crossed. Pipe should not be piled directly on the bare ground; racks or dunnage should be provided.

1840

MT-PWHD-005446

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REDACTED
I-M 83

4. Storing. Pipe should always be blocked to prevent it from rolling. Where practical, pipe should be stored on specially designed sills or racks.

5. Lifting and Carrying

a. Method. When lifting heavy pieces of pipe, bend the knees, keep the back line as nearly vertical as possible, and hold the load close to the body; then straighten the knees and pull the load up directly over the feet. Lift with the legs, not with the back.

b. Forward End Up. Pipe should be carried with the forward end up, so as to clear the heads of other persons.

c. Warning Flag. When pipe is transported on a vehicle, a red warning flag shall be placed on the projecting ends.

d. Team Work. When carrying a long and heavy pipe, each member of the crew should exert the utmost care to work together as a team, while observing the following precautions:

(1) All the workmen must understand the signals for lifting and lowering.

(2) Each man should make sure that his feet are in the clear.

(3) Use the proper tools, either tongs or a carrying bar with a U-shape bend to fit the pipe.

(4) Take a firm grip on the lifting bar or tongs.

(5) Lift at a given signal of the supervisor or co-worker, with all members of the crew lifting and moving together.

(6) Carry the load without sudden starts or stops; move slowly and take care to place the feet firmly.

(7) Stop at the appointed place, and wait for the supervisor's or co-worker's signal to lower.

(8) Lower the load carefully, bending at the knees as in lifting, and lower slowly along with all the other members of your crew.

6. Threaded Pipe. Use caution in handling threaded pipe; the threads are always sharp and will cut the flesh easily. Do not put the hands inside the pipes.

7. Removing From Pile. When removing pipe, work from the top end of the pile as much as possible. Pipe larger than two inches in diameter should be handled by means of a hardwood pipestick.

8. Lifting Devices. Use block and tackle, chain falls, or other lifting devices in handling heavy pipes and fittings.

1208. PIPING SYSTEM REPAIR

1. Tests. Hydrostatic tests of the piping on all naval vessels should be conducted quarterly to detect leaks or other defects in the systems. (For the prescribed pressure tests of fuel oil service piping in oil service systems see *Bureau of Ships Technical Manual,* NAVSHIPS 250-1, chapter 55, "Fuel Oil and Equipment.")

2. Strain on Pipe. Piping shall not be used for handholds or footholds, or be otherwise subjected to strain by such acts as securing chain falls to it or utilizing it as support for weights.

3. Prevention of Corrosion. Corrosion of piping shall be prevented by keeping the exterior of pipes properly painted and free from moisture. Graphite or asphaltum paint is recommended for the exterior of piping. As a general rule, copper and brass pipe should not be painted. The piping in bilges, voids, and ballast tanks should not be painted either, unless it is made of steel or iron unprotected by galvanizing, or unless specifications require painting.

4. Blowing Line. Before dirt or condensate is blown from a pressure line or equipment, care should be taken to see that all persons nearby are in a safe position.

5. Valves. Before repairs to piping systems are attempted, the valves shall always be locked and the system drained. Workmen opening lines or valves should be watchful for any back pressure which may remain, and for hot lines. They shall wear goggles and suitable clothing as protection against escaping gas or liquid.

MT-PWHD-005447

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J-M 83

6. Acids Present. If acids are encountered when repairing a piping system, the pipes shall be drained, all connecting systems blanked off, and the valves properly cleaned and blocked.

7. Water-Hammer. To prevent water-hammer, all water in the steam piping system should be drawn off before steam is admitted.

8. Breaking Flange Joints

a. Pre-Check. Before breaking flange joints, particularly in steam and hot water lines or in those salt water lines of ships which have possibility of a direct connection with the sea, special care shall be exercised to make sure that:

(1) there is no pressure on the line;

(2) the valves which cut pressure off the part undergoing repair are secured in such a manner that they cannot be opened accidentally; and

(3) the line is completely drained.

b. Procedure. When breaking joints let two of the flange securing nuts (the diametrically opposite ones, if possible) remain in place while the others are being removed. Then slack off the two remaining nuts sufficiently to allow breaking of the joint. After the line is proved to be clear, all the nuts may be removed. This procedure prevents the scalding of personnel and the flooding of compartments. Care shall always be exercised to prevent vapor explosions of flammable liquids in lines when joints are broken. When separating flanges with a chisel, drive the chisel first through a small sheet of lead or rubber, and let this remain on the chisel to shield personnel in the area from possible spray.

c. Open Ends. When steam lines are broken for repair, the open ends shall be closed with a blank flange bolted in place. This method of closing the line prevents entry of foreign matter and precludes the possibility of scalding personnel in the event the line becomes charged with steam. Wooden plugs shall not be used for this purpose due to possibility that a leaky valve may cause steam pressure to build up resulting in ejection of plug and possible injuries to personnel.

9. Blow-Out Valves to Sea Chest. When opening the steam blow-out valves to a sea chest to relieve the pressure, care should be exercised to prevent building up a pressure in excess of 35 pounds per square inch in the sea chest.

10. Reducing Valve. When a reducing valve is in use, the inlet valves should be opened "full." Reducing valves must be drained and warmed up before they are adjusted.

11. Warming and Equalizing. Before opening large steam valves the bypass valves should be opened first to warm the lines and equalize the pressures. If there are no bypass valves, the connecting valve should be cracked slightly to accomplish warming and equalizing.

12. High-Pressure Line. Before starting work on a high-pressure air or steam pipe line, the control valves involved shall be wired tightly shut, drained, and relieved of all pressure, and the controlling valves tagged with the following sign: DANGER—DO NOT OPEN. This shall be done prior to breaking or opening the pipe fittings.

13. Cross Connections. When making cross connections, extreme care shall be taken not to connect non-potable water systems to potable systems, or water lines to sewer lines.

14. Chlorine Gas Lines. Whenever artificial heating is necessary with any chlorine gas piping, in order to prevent liquefaction due to unfavorable temperature conditions, such heating should be limited to a maximum temperature of 140° F. Never apply high temperature steam directly to any chlorine gas lines or otherwise raise the temperature of the piping above this limit.

15. Freezing. In freezing weather, auxiliary machinery in exposed positions shall be drained to prevent damage from freezing.

1842

MT-PWHD-005448

REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 1208.8

Subj: Precautions for Breaking Pipe and Valve Bonnet Joints

Ref: (a) NAVMAT P-5100, Chapter 12, Article 1208
(b) LBNS Safety Supplements No. 0651.1 and 0652.4

1. BACKGROUND. Prior to breaking flange joints, particularly in steam and hot water lines which have possibility of a direct connection to the sea, reference (a) requires that special care shall be exercised to make sure that:

a. There is no pressure on the lines;

b. The valves which cut off the part undergoing repair are secured in such a manner that they cannot be opened accidentally; and

c. The line is completely drained. Control valves are wired shut and tagged with a sign "DANGER-DO NOT OPEN" prior to breaking or opening pipe fittings.

While these instructions, if carefully followed, will prevent casualties caused by breaking of flanged joints, it is considered that additional precautions are necessary to prevent injuries to personnel when lighting off machinery systems near the end of overhaul periods. In this connection it must be borne in mind that the major removal and replacement of machinery systems, and the large turnover of ship's personnel during the course of an overhaul, create conditions not usually to be expected in an operating ship, and therefore require extra care to prevent accidents.

2. PROCEDURE. The following precautions will be observed prior to breaking flanged joints or opening valve bonnets in piping systems and prior to applying pressure to piping systems that have been opened or repaired by the Shipyard.

a. Prior to breaking flange joints or opening valve bonnets

(1) It will be determined that there is no pressure on the line in the section to be opened.

(2) The section of line to be opened will be completely drained where practicable.

(3) On ships that have boilers lighted off or piping systems under pressure, the valves that control pressure to the portion of the system being worked on will be wired tight shut and tagged with the following sign: "DANGER-DO NOT OPEN." Because of the conditions cited

MT-PWHD-005449

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above, there will be two valves wired closed and tagged between the part of the system under pressure and the joint being broken. Where two-valve protection cannot be made available, one valve wired and tagged closed and a blank flange properly installed on the open end of the piping end of suitable design and material to withstand the full working pressure and temperature of the piping system, may be substituted on the authority of the Repair Superintendent.

(4) On ships in overhaul or undergoing major repairs, and on which boilers and pressure systems are secured, the requirement for wiring and tagging valves in the closed position that control pressure to the parts of the system being opened need not be observed.

b. Prior to lighting off boilers or applying pressure to piping systems, if all joints in piping systems to which pressure may be applied are not made up, two-valve protection or one valve and blank flange protection will be provided as required above.

c. Prior to breaking joints in piping systems that connect to the sea in any ship regardless of waterborne or in drydock, the requirements of reference (b) will be complied with in providing two-valve protection (wherever possible), cofferdam or blank flange protection that will positively prevent inadvertent flooding.

MT-PWHD-005450

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J-M 83

1209. VALVE STEMS

Important valves in a ship's piping system, and all other valves that are likely to stick should be removed once a month or oftener depending upon the frequency which experience shows to be necessary.

1210. INSPECTION OF SEA VALVES IN DRYDOCK

1. **Inspection and Assembly.** Whenever a ship is placed in drydock, all outboard valves shall be examined under the direction of the engineering officer, and necessary repairs made for placing the outboard valves in efficient condition. When assembling sea gate valves, the gate should be in the half-open position before the bonnet nuts are tightened, to ensure alignment of the guides in the valve bonnet and valve body.

2. **Cold-Water Meters.** Since the ordinary cold-water meter has certain hard rubber parts which will be ruined by distortion if subjected to temperatures above 100° F., cold-water meters shall never be utilized on hot-water lines.

1211. INSPECTION OF TRAPS

All traps in use shall be tested quarterly, and those found to be leaking shall be repaired at once. Particular care should be exercised to keep clean the strainers located ahead of the traps.

1212. THAWING FROZEN PIPES INSIDE BUILDINGS

In thawing frozen water pipes or heating pipes inside buildings, use hot water. Do not use open flame. A safe method is to wrap the frozen section of the pipe with cloths and pour hot water upon them until the ice gives away. Harm to the floor may be avoided by catching the water in buckets or long pans, or by covering the floor with heavy rags or rugs which will absorb the water.

1213. IDENTIFICATION OF PIPING SYSTEMS

1. **Identification of Systems.** Military Standard No. 101 establishes a color code for visual warnings to accompany the written identification of materials conveyed in piping systems and compressed gas cylinders. This color code is applicable to all piping installations where color coding is used in naval shore activities.

2. **Where No Identification Is Provided.** Where piping systems are not properly identified by color schemes, tags, or stencils, and no piping layout is available, care shall be exercised in removing valves and fittings to avoid breaking into live piping systems by mistake.

1214. NEW PIPING WORK

1. **Pulsation and Vibration.** In the installation of new piping adequate provision must be made for expansion and contraction, and for counteracting pulsation and vibration.

2. **Traps and Aircaps.** Steam and air piping shall be equipped with adequate traps or other means for removing liquid from the line. Aircaps shall always be provided on fixtures, and air discharge pipe shall be so installed that pockets where oil may accumulate are avoided.

1215. AIR-COMPRESSOR PIPE LINES

1. **General.** It has been established that explosions in high pressure air systems have occurred due to the presence of oil in the air piping and that such explosions can be prevented by minimizing the amount of oil contamination in the compressed air piping and by observing appropriate operating procedures and precautions. The following precautions have been arrived at through extensive laboratory tests and should be rigorously observed. Their purpose is to provide maximum safety from explosion by the prevention of deposit and accumulation of lube oil in the system.

2. **Inspection of the System.** The compressed air system should be inspected regularly and when oil contamination is suspected. When inspection indicates the presence of lubricating oil in the piping or components in amount more than a light film

1845

MT-PWHD-005451

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REDACTED
J-M 83

coating, the system shall be cleaned in accordance with existing instructions.

3. Drains. Drain moisture separators, interstage separators, air flasks, and receivers frequently to prevent moisture and possible lubricant carryover.

4. Valve Manipulation. Avoid rapid manipulation of manual valves. The heat of compression caused by sudden flow of high pressure air into an empty line or vessel can cause an explosion if oil is present.

5. Cleaning Solvents. Combustible cleaning solvents shall not be used where they may be drawn into the compressor intake, nor used for cleaning compressor parts at any time.

6. Sooty Deposits. Check the compressor discharge for black, sooty deposits. This indicates the existence of conditions which could result in an explosion within the system. When this condition is discerned, measures should be taken to inspect the system to ensure an oil free condition.

7. Application of Heat. Avoid the application of heat to the system piping or components when hot work is being done in the vicinity and avoid striking a sharp or heavy blow on any pressurized part of the system.

8. Charging From Shore. Appropriate precautions should be taken to insure against contamination of the ship's air system when charging from a shore system.

9. High Temperatures. Monitor the system closely to ensure that excessive temperatures which could result in autoignition, do not occur. Hot spots on piping or components as determined by touch should be investigated and corrected.

10. Valve Calibration. When pressure gages must be removed for calibration or other reason, shut the gage valve, but leave the root valve open. Before replacing the gage, shut off the root valve, install the gage, then open gage valve, and finally slowly open the root valve.

11. Testing High-Pressure Gages. Never test high-pressure gages in a dead weight tester that uses oil as a fluid, since even minute amounts of oil remaining in the bourdon tube of the gage represent a potentially dangerous situation. Test in a comparator-type tester or in a dead weight tester which uses distilled water.

12. Fire Preventive Cleaning. Air compressor pipe lines through which hot air passes should be kept clean to avoid the starting of fire in accumulated dust or oil.

13. In Freezing Weather. When shutting down a compressor, all jacket and cooler drains must be opened in freezing weather.

1216. GASOLINE BLOWTORCHES AND PLUMBERS' FURNACES

1. Directions Must Be Provided. Every gasoline blowtorch and plumber's furnace shall be provided with a complete set of operating instructions (i.e., directions for filling, pumping up the air pressure, lighting, and extinguishing), and no one shall use a gasoline blowtorch or plumber's furnace until he has read and is familiar with the operating instructions.

2. Filling Out-of-Doors. Gasoline blowtorches and plumbers' furnaces should, preferably, be filled out-of-doors. If they are filled indoors, they shall be filled at a point remote from open flame, sparks, or other source of ignition. These torches or furnaces shall not be filled while hot. Safety cans shall be used when blowtorches are being filled.

3. Prohibited Fuels. Gasoline containing lead compounds or benzol shall not be used.

4. Filler Plug. Laundry soap may be used on threads of the filler plug to ensure a tight seal. The filler plug should be tightened gently; force may ruin the gasket or strip the threads of the plug. The filler plug shall not be loosened while the burner is hot.

5. Pumping up Pressure

a. Approved Devices Only. Alterations on torches or furnaces which would

1846

MT-PWHD-005452

0008 1135

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J-M 83

permit pumping up the pressure by any method other than the use of pumping devices provided by the torch or furnace manfacturers shall not be made. No device other than the pump supplied with the torch or furnace shall be used to obtain working pressure.

b. Approved Procedure. Preferably, pressure should not be pumped up while the torch or furnace is lighted. Torches shall not at any time be pumped up to excessive pressure. Five to fifteen strokes of the pump are enough, depending upon the size of the tank and the amount of gasoline in it.

6. Storing. Before torches or furnaces are stored the pressure in the tanks shall be released and the valves secured.

7. Test and Inspection. Before torches or furnaces are lighted they shall be examined carefully for leaks.

a. Regular Inspection By Competent Personnel. All torches and furnaces shall be inspected and tested at frequent and regular intervals by competent persons to make sure that the torches and furnaces are in proper operating condition.

b. Defective Torches and Furnaces. Any defect found in torches or furnaces shall be reported at once to the job supervisor. No torch or furnace which is defective in any way shall be used until after such defect has been properly repaired.

8. Overflow

a. Priming Cup. The priming cup should not be overfilled, as the gasoline may flow over the tank and become ignited, thus furnishing sufficient heat to develop a dangerous pressure within the tank. If gasoline should flow over the tank it should be carefully wiped off before the torch or furnace is lighted.

b. Heating Pots. When heating pots, care should be taken to prevent overflow or igniting of the material being heated.

9. Lighting Torches. Torches or furnaces should not be lighted until the gasoline in the priming cup has nearly all been consumed. Immediately after the torch or furnace has been lighted the flame should be shielded from the wind. Windbreaks should be made of noncombustible material, without bottoms and easily removable. Torches and furnaces should preferably be preheated and lighted out-of-doors.

10. Stuffing Boxes. Stuffing boxes shall be kept tight so as to prevent leaks around the valve stem. They shall not be tightened while torches or furnaces are in use.

11. Unventilated Spaces. A torch should not be used in a small unventilated space. It may heat up and thus become a source of danger, and it may exhaust the supply of oxygen, causing the operator to lose consciousness or even his life from suffocation. When such use is unavoidable, it is necessary to provide airfed respiratory protective equipment for the workers.

12. Abuse of Torches. Torches should not be dragged across the floor or abused in any other way.

13. Melting of Lead and Zinc. When gasoline blowtorches or plumbers' furnaces are used to melt materials such as lead and zinc, which may give off toxic fumes, care should be taken to see that proper exhaust or ventilation for such fumes is provided. Suitable ventilation should be provided for possible fumes or gases such as carbon monoxide, which may be generated by the appliances themselves. Safety equipment as designated in NAVEXOS P-422, *Safety Equipment Manual* shall be worn while handling molten metal.

1217. LIQUEFIED PETROLEUM GAS TORCHES AND FURNACES

Torches and furnaces fired with petroleum gases are preferred to those fired by gasoline because of the fewer hazards. However, liquefied petroleum gases, which are composed of propane, propylene, butane, or butylene, present a hazard comparable to that of any flammable natural or manufactured gas and in addition they are heavier than air. Therefore, there must be adequate ventilation of spaces in which the gas is used. Precautions shall be taken to assure that control valves are tightly closed after use and that there are no leaky valves or connections.

1847

MT-PWHD-005453

0008 1136

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I-M 83

SEWAGE AND WATER TREATMENT PLANTS

1220. INTRODUCTION

The operation of sewage and water treatment plants is a hazardous occupation fraught with dangers from noxious gases and vapors, physical injury, and infections. Work should be carried on only under the supervision of an experienced workman or operator who is trained in first-aid and familiar with all the occupational hazards of the work. Procedures and safety precautions prescribed in NAVDOCKS MO-210, *Maintenance and Operation of Water Supply Systems* and MO-212, *Maintenance and Operation of Sewage and Industrial Waste Systems* are applicable.

1221. HOUSEKEEPING

1. **General.** Every effort shall be made to promote good housekeeping at sewage and water treatment plants. Tools shall be picked up, manhole covers promptly replaced, and walkways kept free from greases and oil. The sidewalks of influent and effluent channels, baffles, weirs, launders, and tanks shall be kept clean by hosing, scraping, or brushing. Channels shall be kept free of solids. Dead ends and corners shall be brushed, and all accumulations removed. Icy walks shall be covered with sand.

2. **Fire Prevention.** Sewage treatment plant workers shall never smoke, drop lighted matches, burn tobacco, use open flames (such as pavement asphalt heaters) in or around sewers, screen chambers, sludge digesters, or sewage settling tanks. An ignition spark can even be created while removing manhole covers.

3. **Electrical Apparatus.** Switchboards shall not be used as clothes racks. Special care shall be taken not to work around electrical apparatus or wiring with wet hands, or in wet shoes or clothes.

1222. OPEN TANK PRECAUTIONS

1. **Swimming Requirements.** Workmen on night watch or otherwise required to perform duties alone around open tanks of sewage and water treatment plants shall be required to be capable of swimming at least 100 feet while dressed in the usual type of work clothing.

2. **Lifelines.** When an employee is performing any duties inside the tank guard rail, he shall wear a safety belt and lifeline attached to the guard rail.

3. **Guard Rails and Ladders.** Guard rails shall be maintained around all open sewage and water treatment plant open tanks. Hand holds or suitable ladders shall be maintained on one side wall of each open tank. Suitable hand rails six to twelve inches above the water line shall be maintained on each side of open tanks.

1223. PERSONAL PROTECTION

1. **Work Clothes.** Wearing coveralls, or a complete change to work clothes, is recommended during working hours.

2. **Gloves.** Workmen in sewage treatment plants and sewage pumping stations shall wear rubber (synthetic type) gloves to prevent infection while cleaning clogged sludge pumps and while handling screenings, sewage grit, or other filth. Glove protection is particularly important when the hands are chapped or burned, or the skin broken from any wound.

3. **Rubbers.** Rubbers or boots should be worn to keep feet clean and dry while doing sludge pumping and other chores.

4. **Lamps.** Permissible electric explosion-proof lights or flash lights should be used in deep, dark manhole shafts to prevent physical injuries.

5. **Safety Belts.** Personnel entering deep sewers, where removal in case of injury would prove difficult, shall always wear a safety belt and lifeline.

1224. PERSONAL HYGIENE

1. **Contact With Filth.** It is always wise to avoid actual contact of the hands with sewage, sludge, or other filth.

1848

MT-PWHD-005454

0008 1137

REDACTED
J-M 83

2. Contamination by Hand. Hands must be kept out of the nose, mouth, and eyes. Before eating, hands should be washed thoroughly with plenty of soap and hot water. The finger nails should be kept short and foreign matter removed with a knife, nail file, or stiff soapy brush. Contaminated ends of cigarettes or cigars, or smoking pipes also may introduce infectious material into the mouth.

1225. SAFETY EQUIPMENT

Sewage and water treatment maintenance workers should be provided with the following safety equipment as applicable and in numbers as required:

Equipment	*Use*
Portable air blower (gas-motor or electric-motor operated, see article 1227).	Ventilating manholes and other enclosed subterranean structures.
Electric explosion-proof light.	Illumination in tanks and sewers where gas may be or is present.
Safety belt and life-line.	For entering deep manholes or tanks.
Hose mask.	Respiratory protection in all gas and vapor atmospheres including oxygen deficiency.
Type N canister gas masks.	Respiratory protection for low concentrations of any gas, including carbon monoxide, provided the atmosphere contains sufficient oxygen to support life.
Chlorine canister masks (at plants employing chlorination)	Respiratory protection against chlorine gas leaks.

1226. RESPIRATORY PROTECTIVE APPARATUS

1. **Stowage.** Masks and filters should be kept in accessible locations, but in quarters segregated from probable gas hazards.

2. **Practice in Use.** Personnel directed to use this equipment should practice regularly with it in order to become proficient in putting it on quickly and to become accustomed to breathing through it.

3. **Uses of Various Types**

a. **Canister Gas Masks.** This type of equipment is effective for use in low concentrations of specific gases (such as average chlorine leaks), smokes, vapors and dusts, provided the atmosphere contains sufficient oxygen to support life. The type N all purpose or universal canister gas mask is used for low concentrations of any gas, including carbon monoxide, provided the atmosphere contains sufficient oxygen to support life.

b. **Self-Contained Oxygen Breathing Apparatus.** This is effective for limited time use against any poisonous gas or oxygen deficient atmosphere, such as when inspecting long, large sewers where a hose mask would be impractical.

c. **The Hose Mask.** This equipment can be used for an unlimited time against any poisonous gas or oxygen deficiency.

1227. PORTABLE VENTILATING EQUIPMENT

Portable blowers equipped with vapor-proof, totally-enclosed motors or non-sparking gas engines, should be used when ventilation of tanks, pits, and manholes is necessary. When employed they should be placed on the leeward side of the manhole and not less than 6 feet from the opening. Compressed-air-driven equipment is also safe for use in such locations. When needed, ventilation should be continued in operation while the work progresses, and tests for the presence of dangerous gases or oxygen deficiency should be made at intervals during the time, as well as before, the work is done.

1228. ILLUMINATION

If illumination is required in sewers, pumping station receiving wells, or tanks where flammable gases may be present, permissible electric cap lamps should be worn if

1849

MT-PWHD-005455

0008 1138

REDACTED
J-M 83

available. Approved explosion-proof flashlights and extension electric lights with heavily insulated cords may be used.

1229. WARNING SIGNS

1. **Hazardous Areas.** Warning signs shall be installed near dangerous machinery and blind obstructions, and for any hazardous locations where stumbling may occur.

2. **Fire Prevention.** Warning signs, properly placed, should be used to ban all smoking and open lights in the vicinity of sludge tanks, septic tanks, and sewage conditioning bins. Signs warning against open flames should also be used in sludge digestion tank galleries and in rooms where sludge gas piping and safety devices are located.

3. **Manhole Protection**

a. **Warning Signs and Guards.** When a manhole is opened, a man with a red flag or a red lantern shall be assigned as a guard to warn pedestrians and vehicular traffic. Barricades with suitable warning signs (such as DANGER, MEN WORKING, OPEN MANHOLE, etc.) shall be erected around the manholes. At night, open manholes must be protected with four red lanterns placed about twenty feet away from each other around the manhole in a square formation, with one lantern located about 10 feet ahead of the opening so as to be easily discernible by approaching traffic.

b. **Manhole Cage.** A manhole cage over the shaft should be provided for protection to the workmen in the sewer because it affords them a handhold in descending and ascending the manhole shaft.

1230. SEWER MAINTENANCE

1. **Ladder Testing.** Workmen descending a manhole shaft to inspect or clean sewers shall try each ladder step or rung carefully before putting their full weight on it to guard against insecure fastening due to corrosion of the rung at the manhole wall.

2. **Helpers for Emergency.** When work is going on in deep sewers at least two men shall be available for lifting workers from the manhole in event of serious injury.

1231. ENTERING DEEP SEWERS

1. **Procedures.** When entering a large or deep sewer or underground structure where dangerous gas or an oxygen deficiency may be present, sewer maintenance crews shall follow these procedures:

a. Do not allow smoking or open flames, and guard against sparks.

b. Erect warning signs.

c. Use only safety gas-proof electric lighting equipment.

d. Test the atmosphere for noxious gases and oxygen deficiency.

e. If the atmosphere is normal, allow workmen to enter with a safety belt attached and with two men available at the top. For extended jobs, the gas tests should be repeated at frequent intervals, depending on circumstances.

f. If oxygen deficiency or gas is found, ventilate the structure with pure air by natural or artificial means. The gas tests should be repeated and the atmosphere cleared before entering. Adequate ventilation must be maintained during this work, and the tests frequently repeated.

g. If gas or oxygen deficiency is present and it is not practical to ventilate adequately before workers enter, use a hose mask and take extreme care to avoid all sources of ignition. Workers should be taught how to use the hose equipment. In these cases they should always use permissible safety lights (not ordinary flashlights) and wear rubber boots or nonsparking shoes.

2. **Assignment of Workers.** Work in flammable gas atmospheres is extremely hazardous; it should never be attempted except by those thoroughly familiar with the dangers and fully equipped with the proper protective safety equipment.

1232. PURGING SLUDGE HOLDER

1. **Before Entering.** Before entering a digester tank which has been emptied, make sure that it has been purged with live steam or CO_2 and then thoroughly ventilated.

2. **Procedure.** When purging sludge gas holders, the bottom entrance manhole cover

1850

MT-PWHD-005456

0008 1139

REDACTED
L-M 83

should be removed and the gas vented to the atmosphere through all available openings in the top. All sources of possible ignition for the gas mixture should be carefully controlled during this operation. A combustible gas indicator should then be employed to check the tank atmosphere before entering.

1233. CHLORINE LEAKS

1. **Respiratory Apparatus.** No one should knowingly enter a room into which chlorine is leaking unless he is wearing a chlorine gas mask, a self-contained oxygen breathing apparatus, or a hose mask.

2. **Conduct in Presence of Chlorine.** When chlorine is noticed in the atmosphere workers should avoid panic, refrain from coughing, keep the mouth closed, avoid deep breathing, keep the head high, and withdraw at once from the affected area. The gas mask or oxygen breathing apparatus shall then be put on and the room reentered to shut off the leak if that is possible.

3. **Persistent Leaks.** The handling of a persistent chlorine leak in a plant is best left to the chlorine supplier.

4. **Handling Chlorine Cylinders.** Workmen shall handle chlorine cylinders with care. Rough handling of cylinders shall not be tolerated. Workmen should not tamper with the valve or apply flame, steam, or hot water to it, or place the cylinders near steam pipes or radiators. When using these cylinders they should open the valve slowly, leaving the special wrench in place, and close the valve when the cylinder is empty. Instructions in the use and care of cylinders shall be observed.

1234. FIRST AID FOR CHLORINE POISONING

1. **Measures to Be Taken.** Should any of the plant personnel become seriously affected by chlorine gas, or be overcome by its action, the following steps should be taken:

a. Call a physician.

b. Remove the affected person at once to open air and away from gas fumes.

c. Place the patient flat on his back with his head slightly elevated. Keep him warm, and do not excite him.

d. If the patient is conscious, give him one-half teaspoonful of essence of peppermint, or a moderate stimulant. Do not give him milk as milk or cream will usually curdle in the stomach and cause vomiting, which adds to the discomfort of the patient.

e. Insofar as he is able, the person affected should resist the impulse to cough.

f. If the patient is unconscious and not breathing, apply artificial respiration.

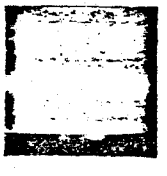
1235. PIPING IN TREATMENT PLANTS

1. **Cross Connections.** Cross connections between the drinking water supply and the sewage or sludge piping or the equipment in sewage and water treatment plants are prohibited. Continuous diligence must be exercised to avoid making such connections.

2. **Temporary Piping or Hose.** Temporary water flushing pipes or hose shall not be allowed to remain connected with sewage or sludge pipes or tanks after use.

MT-PWHD-005457

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J-M 83



MT-PWHD-005458

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J-M
83

LBNS SAFETY SUPPLEMENT NO. 1311

Subj: Applying/Removing Anti-fouling paints and coatings containing Organo-tin to Ship's External Hulls; Safety Precautions for

Ref: (a) NAVMAT P-5100, Chapter 13, Article 1311

1. PURPOSE. To supplement reference (a) with specific precautions to be observed when applying/removing anti-fouling paints and coatings containing Organo-tin to ship's external hulls. These safety and health precautions must be followed in order to minimize the possibility of physical injury to personnel involved with the overhaul of ships coated with such paints.

2. BACKGROUND. Experience has shown that paints containing organotin-compounds and anti-foulants are highly irritating to the skin, eyes, and respiratory tract either by direct contact with the paint or coated surfaces, or by exposure to vapors released from the coating. Organo-tin compounds may be absorbed through the skin or cause blisters to form. Release of the vapors in harmful amounts may occur for many months following application of the coating. Skin burns have also occurred among personnel exposed to rain water which had been in contact with the dry coating. Any operations involving welding or burning or otherwise heating the dried coating will also release toxic and irritating vapors. Any dust generated during coating removal operations would also be toxic and irritating. Past experience has indicated that exposure to vapors can be significantly reduced by applying the antifouling coating as the last operation prior to undocking.

3. PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING

a. All personnel engaged in application/removal shall wear the following:

(1) Full Face airline respirator

(2) Tank Suits with long sleeves and all openings taped

(3) Cotton Gloves

(4) Hood

b. All other personnel whose presence is required in the Dry Dock will wear the following:

(1) Organic Vapor Respirators (Note: Those personnel exposed to spray mist or vapors should be provided a chin type gas mask with full face protection.)

MT-PWHD-005459

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 1311

Subj: Applying/Removing Anti-fouling paints and coatings containing Organo-tin to Ship's External Hulls; Safety Precautions for

Ref: (a) NAVMAT P-5100, Chapter 13, Article 1311

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2. BACKGROUND. Experience has shown that paints containing organotin-compounds and anti-foulants are highly irritating to the skin, eyes, and respiratory tract either by direct contact with the paint or coated surfaces, or by exposure to vapors released from the coating. Organo-tin compounds may be absorbed through the skin or cause blisters to form. Release of the vapors in harmful amounts may occur for many months following application of the coating. Skin burns have also occurred among personnel exposed to rain water which had been in contact with the dry coating. Any operations involving welding or burning or otherwise heating the dried coating will also release toxic and irritating vapors. Any dust generated during coating removal operations would also be toxic and irritating. Past experience has indicated that exposure to vapors can be significantly reduced by applying the antifouling coating as the last operation prior to undocking.

3. PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING

a. All personnel engaged in application/removal shall wear the following:

(1) Full Face airline respirator

(2) Tank Suits with long sleeves and all openings taped

(3) Cotton Gloves

(4) Hood

b. All other personnel whose presence is required in the Dry Dock will wear the following:

(1) Organic Vapor Respirators (Note: Those personnel exposed to spray mist or vapors should be provided a chin type gas mask with full face protection.)

MT-PWHD-005460

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(2) Tank suits with long sleeve and all openings taped

(3) Cotton Gloves

(4) Hood

c. The Safety Officer, Industrial Hygienist, and the Ship Superintendent will inspect the drydock area to insure that all safety requirements set forth in this instruction are complied with. In addition, the ship/ships under repair will provide a drydock watch to insure that only personnel wearing the proper protective clothing enter the Drydock during application of subject paint.

d. Shop 71 will install safety signs to warn of the toxic nature of organo-tin paints.

e. CAUTION - Since these coatings are considered extremely dangerous, no one shall be allowed to deviate from these procedures.

4. CONTROL PROCEDURES

a. Scheduling of work. Week-ends and night shifts should be utilized to the greatest extent possible in order to minimize number of personnel in the environment.

b. Notification of work should be given to shops/codes, ship under repair, and other ship in the same drydock. Warning should be provided that a toxic and corrosive spray or dust/mist/will be generated and that only essential personnel may remain in the drydock. The shop(s) involved should receive a copy of this instruction as a basis on which to program protection of their personnel.

c. All non-essential equipment and material will be removed from the drydock to preclude contamination. To prevent subsequent contact by personnel, all possibly contaminated surfaces within the Drydock should be flushed with water.

d. No hot work will be permitted in the drydock during application/removal of organo-tin paint.

5. GENERAL HEALTH PRECAUTIONS

a. Do not smoke, eat or bring food or tobacco into the drydock during application/removal of subject paints.

b. Avoid inhalation of, and skin contact with, organo-tin paint or its dust. If accidental skin contact occurs wash affected areas with soap and water. If dust or pain enter the eye, immediately flush with water for ten minutes and then report to the dispensary.

MT-PWHD-005461

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J-M 83

Do not use solvents or oil base cleaners to remove dry paint from the skin. Solvent cleaners will actually remove the protective coating of natural oils from the skin and allow the paint to have a greater corrosive effect.

c. Personnel with a history of asthma or other respiratory problems, liver or blood ailments should be excluded from working on removal and/or apllication of organo-tin based paints.

d. Only essential personnel will be permitted in the drydock.

e. Shop 99 shall install a protective decontamination shower on the drydock floor as specified by the Ship Superintendent.

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MT-PWHD-005462

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J-M 83

Chapter 13
PAINTING

GENERAL

1301. FIRE HAZARDS

The use of paints, varnishes, lacquers, cleaners, solvents, and other finishing materials containing flammable solvents readily ignitable at comparatively low temperatures involves a marked fire hazard. Liquids containing volatile flammable solvents exposed to evaporation form flammable vapors which, if not cared for by adequate ventilation, may form explosive or flammable mixtures with air. The National Fire Protection Association Inspection Manual and Chapter 20 shall be used as a guide in handling, storing, and using flammable liquids.

1302. CONTAMINATION OF AIR

Vapors and gases from cleaners, solvents, and paints frequently have a harmful toxic effect on the human system. Every precaution should be taken to prevent excess contamination of the air by solvent vapors. This applies to tank-type cleaners, lacquer thinners, benzine, naphtha, paints, solvents, etc.

1303. PAINT STORAGE

Containers holding paints, varnishes, lacquers, removers, thinners, cleaners, or any volatile solvents shall be kept tightly closed when not in actual use. They shall be stored in a separate building or in a fire-resisting room which is well ventilated and where the paint material will not be exposed to excessive heat, smoke, sparks, flame, or the direct rays of the sun. Wiping rags and other flammable waste material shall always be placed in tightly closed metal containers, and the containers must be emptied at the end of a day's work. Painters' overalls should be hung in metal lockers.

1304. PAINT REMOVAL WITH TORCH

Removal of paint by torch is prohibited.

1305. TOXIC AND POISONOUS SUBSTANCES

Good habits of personal hygiene will prevent lead poisoning. Certain paints and organic solvents irritate or burn the skin and should be handled with approved gloves. See 1311.

PAINTING

1310. PAINTING AREA

1. **Mixing Paint.** Painters should have detached shops or temporary structures where all paint should be mixed, and where paint buckets, brushes, and rags can be kept at the end of the day's work. Only the quantity of oil or paint needed for one day's work shall be taken into the building being painted. Paint mixing and storage shops other than structures of temporary nature should be protected by automatic sprinklers.

2. **No Smoking.** Signs reading "No Smoking Allowed In or Around This Building" should be posted conspicuously inside and outside each paint shop or other building in which paint is used or stored. No open flame of any kind shall be allowed near paint-mixing operations.

MT-PWHD-005463

0008 REDACTED J-M 83

3. Ventilation. Forced draft ventilation should be provided for personnel engaged in scaling, brush painting, spraying, and in using paint removers.

4. Aloft or Overside. Before painting, inspect scaffolding and rigging for safety. Lifelines should always be worn on this work, with the lifeline secured. When brush painting from ladders, the paint bucket should be hung from a ladder rung with a suitable hook, and the painter shall hold onto the ladder with one hand. See Chapter 8 of this publication for precautions on scaffolds and ladders.

5. Housekeeping. Good housekeeping must be especially stressed where painting work is being done.

1311. HEALTH HAZARDS AND PROTECTIVE EQUIPMENT

1. Medical Examinations. Painters must continuously observe good habits of personal hygiene to avoid the health hazard of lead poisoning. Medical examinations of painters should be conducted periodically in the course of continued work with toxic paint materials. (See NCPI 792.)

2. Respirators. Chemical cartridge type paint-spray respirators shall be worn when it is necessary to work in harmful concentrations of fumes or vapors. In confined spaces where the possibility of reduced oxygen content may occur, airline type respirators or self-contained breathing apparatus shall be used.

3. Thorough Washing. Strict adherence by painters to a system of good personal hygiene in washing with the proper type of soap or detergent, eating, drinking, etc., will practically eliminate the possibility of lead poisoning. Painters should be particularly careful to keep dirty fingers out of the mouth and away from food and other substances going into the mouth. Painters should always wash hands, arms, and face with warm water and soap before eating.

4. Gloves. Rubber gloves should always be worn when handling cleaning compounds, thinners, paints, removers, or other materials that may irritate the skin. A protective cream should be used on exposed parts of the skin to act as a barrier and to facilitate cleaning after painting. This will eliminate the need for using irritating solvents.

5. Life Jackets. Each man shall wear a properly fitted life jacket when working in a precarious position near or over water, or at an elevated position, with a lifeline of such length (no more than 2 feet of slack) that the jolt from a fall would not injure him. Since injuries to painters often result from the improper use of ladders and scaffolds, personnel should also observe the precautions given in Chapter 8.

6. Antifouling Paint. Care shall be taken not to get any plastic antifouling paint on the face, hands, or clothing, as it will burn the skin. Masks and gloves shall always be worn when using this kind of paint.

1312. SPRAY PAINTING

The following precautions cover the more essential requirements for safe paint spraying operations. National Fire Protection Association pamphlet No. 33, *Spray Finishing Using Flammable Materials*, gives more details on the equipment, operation, and maintenance of paint spraying facilities which should be followed wherever practicable.

1. Dangers. The application of paints, varnishes, lacquers, enamels, wood bleaching liquids, and other flammable liquids by the spray process is more hazardous than brush applications because of the volume and concentration of the work and because spraying produces a residue of flammable character and deposits which are subject to spontaneous ignition. Health hazards due to the presence of potentially harmful substances such as lead, benzol, and silica may also be present in paint spraying operations.

2. Ventilation. To insure immediate removal of vapors and waste residues from spraying operations, complete ventilation of the room is essential. However, adequate ventilation may and usually does require positive means in addition to natural ventilation.

1857

MT-PWHD-005464

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J-M 83

A system balanced so as to provide fresh air supply as well as exhaust is therefore recommended. Ordinarily the ventilation necessary for the health and comfort of the operators is sufficient also to remove flammable vapors.

3. **Protective Clothing.** Operators of spray machines shall wear protective garments which fit snugly at the ankles, neck, and wrists. They shall wear gloves, and approved filter-type respirators while spraying or when mixing dry colors or using other finishing materials which create flammable vapors. They should never inhale the mist from the spray gun.

4. **Showers.** Where paint-spraying operations are conducted extensively, showers should be installed close by and the employees should use them after every shift.

5. **No Smoking.** Smoking is prohibited in rooms where spray guns are in operation. The presence of any open flame is forbidden in such locations.

6. **Electrical Equipment.** Electrical equipment in rooms where paint-spraying or extensive paint mixing operations are carried on, or where large quantities of paints are stored, should be installed in accordance with Class I, Group D requirements of the National Electrical Code.

7. **Fire Fighting.** Spray machine operators are to be informed of the location of the nearest fire-fighting equipment, and they must know how to use such equipment.

8. **No Loitering.** Only authorized personnel shall be allowed in spray painting rooms.

9. **Spray Booths.** Where paint spraying operations are regularly conducted inside a building or structure, a standard metal spray booth with an exhaust system using type D motor should be provided which complies with the requirements of the National Board of Fire Underwriters.

a. **Cleaning Booths.** Compressed air or flammable liquids should not be used for cleaning these booths.

b. **Sprinklers.** Every spray booth should be provided with automatic fire-extinguishing system. If the sprinklers are subject to loading by paint deposits they should be cleaned frequently.

10. **Cleaning Spray Guns.** Spray guns, paint containers, and hose must be thoroughly cleaned after use but should never be cleaned in confined areas.

1313. BITUMINOUS AND PLASTIC COATINGS

1. **Hazards.** There are two types of coatings generally used to protect surfaces against saltwater corrosion. The bituminous type (asphaltic, coal tar) have a volatile vehicle which has toxic and combustible properties. The plastic coatings (chlorinated vinyl resins and other plastics) also have toxic and combustible properties. Although the volatile vehicle of the plastic coatings generally have more severe toxic properties, many of the same safety precautions are applicable to both types.

2. **Confined and Unconfined Application.** The following precautions shall be observed in applying these coatings both in confined spaces such as the interior of ballast tanks and in the open.

a. **Protective Apparel.** Legs shall be protected below the knees by approved leggings of canvas material. Shirts must be kept buttoned at the neck and the sleeves rolled down. Leather gauntlet gloves shall be worn. Approved goggles shall be worn except where eye protection is provided by air-supplied respirators or hoods. Exposed areas of the skin should be covered with a protective cream.

b. **Hoods.** Where these coatings are applied overhead or on surfaces above waist level of the workmen, approved hoods which completely protect the head, face, and neck shall be worn.

c. **Open Flame.** No smoking or welding or other open flames will be permitted in enclosed spaces, or within 50 feet of the place where these coatings are being applied. The restricted area shall be clearly designated by suitable light barricades and warning signs reading: "DANGER, NO SMOKING."

1858

MT-PWHD-005465

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J-M 83

d. Mixing. Coatings shall be prepared in enclosed mixing equipment located in an open or well-ventilated space. The area shall be barricaded for a distance 30 feet each way from the mixing equipment and "danger–no smoking" signs.

e. Maintaining Watch. A continuous watch should be maintained during application of these coatings, to ensure that all safety precautions are observed.

f. Grounding. All spray guns shall be grounded and the ground leads shall be taped to the spray gun where practicable to discharge static accumulations.

g. Respirators. Chemical cartridge respirators, protecting against organic solvent vapors, shall be worn by all persons working within 15 feet of either mixing or coating operations, except where coating is done in confined spaces, where air-supplied hoods or respirators shall be used.

h. Accidental Ignition. Extreme care shall be taken by persons engaged in preparing and applying these coatings to eliminate all possible sources of ignition (matches, cigarette lighters, steel buckles, etc.) from their persons. Workmen shall wear canvas boots over their shoes or shall wear rubber footwear where they must stand on steel decking to apply the coatings. Plastic clothing shall not be worn. All loose steel objects shall be removed from the immediate vicinity of the coating operations.

3. Application in Confined Spaces. In addition to the precautions given in paragraph 2 above, the following precautions shall be observed when applying bituminous and plastic coatings in confined spaces such as interiors of ballast tanks.

a. Forced Ventilation. During coating operations all tanks shall be properly force-ventilated.

b. Vents. Where the venting of the vapors given off by the coatings will create an explosion hazard outside the compartment being coated, water curtains shall be installed at the vents and ventilation shall be continued for at least one hour after the coating operation has been completed and until vapor concentrations remain below those prescribed for the materials involved.

c. Respirators. Air-supplied respirators shall be worn by all personnel working in enclosed spaces where these coatings are being applied.

d. Sparks. Coating operations shall not be conducted in enclosed spaces where spark-making apparatus is in use. All electrical equipment except explosion-proof types shall be shut down and all electrical circuits deenergized.

e. Gas-Free Testing. Frequent gas-free tests shall be conducted in accordance with the procedures stipulated in Chapter 20.

f. Portable Lights. Portable lights shall be hung on stiffeners by means of insulated hooks and never wrapped around or dropped over supports.

1314. RUST-PREVENTIVE COMPOUNDS

1. Ventilation. When cleaning and spraying with rust-preventive compounds special care shall be taken that working spaces are always well ventilated.

2. Open Flame. Smoking, welding, oxyacetylene burning, or any other operation involving open flames or sparks, shall not be allowed in the same compartment where rust-preventive compound is being used. In the open air, burning shall not be carried on within 20 feet of spraying.

3. Preventing Electric Sparks

a. Shoes. Only nonsparking shoes should be worn by personnel working with rust-preventive compounds.

b. Equipment. Only explosion-proof electrical equipment shall be operated in such places.

c. Grounding Spray Gun. A spray gun used for spraying rust-preventive compounds shall be grounded to eliminate any generated electro-static charge.

4. Personnel Protection

a. Ointment. Protective cream or ointment should be applied to parts of the body which are exposed to contact with these vapors.

1359

MT-PWHD-005466

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 1313

Subj: Ships' Underwater Hull Coating Applications

1. The following precautions must be observed prior to and during the application of underwater epoxy, epoxy anamid primers, and the non-photochemical solvent anti-fouling coatings. These coatings cure with a low level of solvent release, thereby reducing the danger of organic solvent explosion hazard. There still exists fire hazard when large areas of a hull are in a "wet" state. There still exists a fire hazard in the mixing and stowage areas.

a. ALL Shops

1. No smoking, welding, or other open flames will be permitted within 50 feet of the point of airless or conventional spray application. Where necessary to progress scheduled controlling work, the General Foreman Painter will establish hot work areas.

2. The General Foreman Painter will notify topside welding operations of the existence of areas of "wet" hull conditions in order to control spark ignition of coatings by communicating with the Welder General Foreman.

3. General Foreman Painter will notify Shop 26 General Foreman on "wet" hull areas in order to control internal hot work. No internal hot work permitted in "wet" hull areas until cure time occurs.

4. Full or empty paint cans are not to be used for stools or seats, paint cans are unsafe work horses and are a fire hazard.

5. All persons in the drydock must wear approved safety shoes and approved safety glasses.

b. Shop 71

1. When large areas are being painted, the General Foreman Painter shall keep the General Foreman Welder informed. Areas and cure time should be clearly defined. No welding within 50 feet of "wet" area is permitted.

1860

MT-PWHD-005467

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J-M 83

2. Empty paint cans in the drydock floor shall be controlled immediate disposal. Empty or unopened paint cans will not be used : stools or seats. The paint stowage area will be restricted to the illest area practical.

3. No smoking and Restricted Area Signs will be posted in the int mixing and paint stowage area of the drydock.

4. Clean-up of spray equipment shall be done under "No Hot Work" nditions. All material lines must be rolled up, and all solvents will disposed in collection drums at the mixing or stowage areas.

5. Stowage of open cans of paint not permitted in the drydock. rtially full cans must have lids.

6. All spray operators and workers within 25 feet of point of plication must wear approved air-fed or chemical cartridge respirators appropriate. Painters must wear gloves and protective hand cream.

7. All persons in the drydock must wear approved safety shoes d safety glasses.

8. In order to reduce shock hazard, water curtain dust suppressors ll be shut off when not in use.

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J-M 83

b. Apparel. Protective gloves shall be worn when applying cleaning liquid or when spraying, brushing, flushing, or dipping with the compound.

c. Respirators. When using rust-preventive compounds in a confined or poorly ventilated space, an air-supplied respirator shall be worn. When spraying, brushing, flushing, or dipping with this compound in the open air, a chemical cartridge respirator shall be worn.

1315. PAINTING BY DIPPING

1. Hazards. Painting by dipping objects in tanks of paint, enamel, varnish, etc., involves the hazard of exposed surfaces of flammable liquids and the evaporation of solvents.

2. Ventilation. Complete ventilation of the area in which dipping operations are carried on is essential. Dipping should preferably be carried on in a detached building or a cut-off section; it should not be conducted in spaces where ventilation is difficult to obtain.

3. Tank Covers. Small dip tanks can be protected by automatic-closing covers. Such covers should be held open either by a fusible link or by some form of thermostatic device designed to close the cover and cut off the air supply in case of fire.

4. Overflow Pipes. Overflow pipes should be provided for all dip tanks to prevent spillage and designed so that the contents of the tank can in the event of an emergency be drained to an underground tank located outside the building.

5. Drain Boards. Drain boards on which the surplus finish drips from articles leaving the dip tank are a point of hazard and should be included in the protection for the tank.

6. Open Flame. No smoking or open fires shall be permitted in areas where paint dipping operations are conducted. Only standard methods of heating shall be employed in such areas. The National Fire Protection Association *Standard for Dip Tanks Containing Flammable or Combustible Liquids* gives detailed requirements for safeguarding this process.

1316. CLEANERS AND SOLVENTS

Solvents and cleaners used in connection with painting operations are comprised of a variety of types of compounds including hydrocarbons, acids, alcohols, caustic materials, and chlorinated compounds. Many of these are hazardous. Such materials shall be handled and stored with due regard to their particular properties concerning toxicity and flammability in accordance with the precautions provided in Chapter 20.

ABRASIVE BLASTING

1320. GENERAL

1. Abrasive Machine. The abrasive-blast machine (sometimes referred to as a pot, sand tank, pressure tank, etc.) is a pressure vessel, either single or double, utilizing compressed air and abrasive material, which may be either wet or dry.

2. Care of Equipment. [illegible] a result of weakness developed by [illegible]on or from structural damage caused [illegible] handling or flying objects, explosion may occur. Adequate maintenance of equipment is basic to the safe operation of abrasive-blast machines. Careful attention to control valves, hose, nozzles, and the strict adherence to correct operating procedures on the part of the operator will prevent accidents.

3. Work Area. Abrasive workrooms must be adequately lighted with vapor-proof lights, and have emergency escapes installed on the doors.

4. Dry Abrasive Blasting. Dry abrasive blasting carried on inside a building shall be done in completely enclosed booths.

1862

MT-PWHD-005469

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J-M 83

5. **Hazards.** The chief dangers to personnel are:

a. explosion
b. breathing abrasive material
c. bodily contact with abrasive stream
d. surges in the sandblast line.

1321. PROTECTIVE CLOTHING

1. **Specifications.** Protective equipment and clothing for abrasive blasting is described in the *Safety Equipment Manual,* NAVEXOS P-422.

2. **Apparel.** All blasters shall wear hoods, masks or air helmets of the positive pressure type, steel-toe boots or shoes, rubber or leather gauntlet gloves, and appropriate clothing.

3. **Safety Belts.** Blasters working on staging or other elevated places or platforms shall wear safety belts whenever adequate safeguards against falling, such as guard rails, cannot be provided.

4. **Hats.** Blast-cleaning machine operators shall wear hard hats, goggles, and respirators.

1322. SPECIAL FEATURES OF EQUIPMENT

1. **Air Washer.** This device is a sheet metal chamber of any desired size and shape, to be used with fan duct systems. It is equipped with either a water spray, which will clean the air of coarse dust particles, or steam spray, which will wash out fine dust particles so small as to be virtually invisible. Steam ejectors may be used in lieu of fans in a duct system and in this case a water spray chamber both at the suction and discharge ends of the ejector will wash out all of the dust in the dusty air stream.

2. **Automatic Safety Shut-Off.** The nozzle end of blasting hoses shall be equipped with a control device that will stop air pressure and abrasive material from entering the blasting hose when the control is released. The device shall incorporate the *dead-man* control principle.

3. **Nonstatic Hose.** Nonstatic hose should be used to prevent shocks from static electricity.

4. **Whip Hose.** A short length of flexible hose between the nozzle and the relatively stiff abrasive-blast hose is generally used to enable the blaster to bend the hose and point the nozzle toward the work at the necessary angle. This short hose must be able to withstand bending under pressure and have good wearing qualities. When bent, the hose will wear unevenly; frequent and thorough inspection is necessary to insure replacement of the hose before an unsafe amount of wear has taken place.

5. **Hose Couplings.** Hose lengths should be joined by metallic couplings secured to the outside of the hose to avoid erosion and weakening of the couplings. Couplings should be so designed as to allow ready joining of the hose lengths and should preferably be of aluminum for light weight.

6. Nozzles

a. **Attachments.** Nozzles must be attached to the hose by a fitting that will positively prevent the nozzle from becoming disengaged and flying through space like a missile. Nozzle attachments shall be of metal and shall fit onto the hose externally.

b. **Regulators.** Nozzle and fitting designs that allow regulations of the air-abrasive stream during blasting are considered unsafe, and shall not be used.

c. **Handling.** Nozzles are usually brittle and striking anything with the nozzle or dropping it should be avoided.

1323. BODILY CONTACT WITH ABRASIVE

1. **Direction of Nozzle.** Be alert to prevent the air-abrasive mixture from being directed against the blaster himself or another person. Never point the nozzle in the direction of another person, even with the air and abrasive shut off.

2. **Hands.** All abrasive-blasters should keep hands and other parts of the body away from the discharge end of the nozzle, including times when the abrasive stream is shut off or temporarily clogged.

1863

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 1320

Subj: Sandblasting Precautions

Ref: (a) NAVMAT P-10470

1. POLICY. Numerous hazards are inherent in sandblasting operations, and these hazards are greatly increased when the operation occurs in a confined area such as a tank or enclosed compartment. Therefore, all Group Superintendents, Production Shop Heads and office heads will take action to insure that personnel under their cognizance working in the trade of sandblasting and allied or assist trades are properly instructed in all safety precautions and preventive measures described in this manual and other safety instructions pertaining to sandblasting. In addition, they will insure that the instructions are adhered to at all times.

2. TRAINING IN SAFE USE OF EQUIPMENT. The Service Group will insure that new employees are trained in safety precautions to be exercised in sandblasting and allied operations and the purpose, use and maintenance of the breather pot, full-face respirator, and other allied equipment as set forth in reference (a). In addition, semi-annual safety drills will be conducted for personnel engaged in the trade of sandblasting and allied operations, with assistance being provided by the Safety Division if deemed necessary.

3. INSPECTIONS OF EQUIPMENT. The sandblaster supervisor, prior to commencement of tank work or work in enclosed compartments after each new docking, will inspect the breathing air setup with particular attention directed to breather pots and filters for proper operation. In addition the sandblaster supervisor will make periodic inspections of breathing air setups during extended dockings (more than three weeks in duration).

4. EQUIPMENT ISSUE AND RECALL CONTROL. The Mechanical Group will insure that air line filters, breather pots, respirators and respirator in-line filters are issued and controlled in accordance with LBNS Safety Supplement No. 0114.6.

5. EQUIPMENT PROCUREMENT AND MODIFICATION

a. The Plant Equipment/Facilities Branch of the Production Department will:

(1) Take action to procure modern and practicable safety equipment for good communications between sandblasters in tanks or compartments and other personnel who may be working in locations where they cannot be observed by an attendant, but where the atmosphere is such that a full-face respirator or hood is required.

MT-PWHD-005471

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J-M 83

(2) Assist Production shops in procuring new safety equipment for sandblasting and allied operations, or modernizing existing equipment to conform to safety standards as set forth in paragraph 5.b. below.

b. The Mechanical Group (Shop 06) will:

(1) Insure that all previously issued full-face respirators not containing an air line filter be immediately recalled and replaced with a filter unit and all subsequent non-filtered units in stock be modified to include a filter or be surveyed.

(2) Insure that all new sandblasting safety equipment and allied safety equipment is in a safe operating condition prior to issue.

6. CHEST X-RAY EXAMINATIONS. Personnel engaged in sandblasting will be required to have an annual chest x-ray examination conducted by the Shipyard Dispensary.

7. PERIODIC PREVENTIVE MAINTENANCE INSPECTIONS. The Public Works Department will assure that periodic preventive maintenance inspections are conducted on compressed air plants and distribution systems. Maintenance actions required which may interfere with productive work will be coordinated beforehand with the Production Department.

8. EMPLOYEE EDUCATION

a. Written instructions in the use, care of equipment, and safety requirements in sandblasting and allied operations will be furnished to all employees engaged in such trade.

b. Large posters containing pertinent information relative to breathing air respirators and sandblasting safety will be conspicuously displayed in all tool cribs issuing such equipment and in selective work areas of sandblasting and allied operations.

c. The Safety Division will assist in conducting training, indoctrination and drills on safety requirements in sandblasting and other full-face respirator equipment; assist in developing instructions and posters; and interpret safety standards pertaining to sandblasting and full-face respirator equipment.

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3. **Adjusting Nozzle.** Do not attempt to tighten or loosen the nozzle while the abrasive is flowing.

1324. HOSE BREAKAGE

Inspect hose frequently and replace that which shows an unsafe amount of wear. Breakage of the hose, either as a complete separation or through wear, might cause bodily contact with the abrasive stream, and a complete separation in the hose may cause it to whip about and strike a person.

1325. DUST

1. **Hazards.** Dust from removed rust, scale, and paint is a menace to machinery and to the health of persons in the vicinity. Abrasive slag grit or equivalent should be used whenever practicable (such as in extensive, continuous, or repeated blasting operations) since it is practically silica-free and less injurious to personnel. Where sand is used, the following precautions shall apply:

a. All personnel engaged in this work shall be equipped with approved air line respirators and shall be given periodic physical examinations in accordance with NCPI 792, enclosure 1.

b. Personnel engaged in work in the vicinity of sandblasting operations shall wear an approved dust respirator.

c. Warning signs marking out the danger area shall be posted. They shall state: DANGER–SANDBLASTING, ALL WORKING NEARER SANDBLASTING THAN THIS SIGN MUST WEAR A DUST RESPIRATOR

2. **Liquid Hose Line.** Dust from blasting of ships' hulls should be suppressed by the use of the rust-inhibiting liquids, fed into the hose at the blasting machine or sprayed from a spray nozzle, concentric with and attached to the abrasive nozzle and fed by a separate liquid line.

3. **Suction Ducts.** Dust generated by dry blasting of closed spaces aboard ships should be withdrawn by adequate suction ventilation ducts and fans. The dust in the air stream should be washed out in air washers before the air is expelled into the atmosphere.

1326. SURGES IN ABRASIVE-BLAST LINE

1. **Danger.** Surges in the line can result in recoil action at the nozzle, of sufficient proportions to knock a man from a staging or wrench the hose from his grasp.

2. **Surges.** Surges are caused by interruptions of the air supply, irregular feeding of abrasives and liquids into the line, and by improper manipulation of the valves at the machine. This is especially likely to occur during changeover from an empty abrasive tank to a full one.

1327. COMMUNICATION

Adequate means of communication between the blaster and the machine operator shall be maintained. Telephone communication, preferably the sound powered telephone (or other direct electronic voice transmitting devices), shall be used.

1. When blaster and machine operator are clearly in sight of each other, well defined and understood hand signals may be used.

2. Other signaling devices such as horns and electric lights are not recommended.

1328. STAGING

1. **Rigidity.** Abrasive blasters, being enclosed completely in protective clothing, are restricted in freedom of movement and in ability to see. Furthermore, the blasting hose is stiff to maneuver and has considerable weight. It is important, therefore, that any staging on which the blaster must work should be as firm, rigid, and steady as possible.

2. **Specifications.** Staging should be at least 24 inches wide and wherever practicable shall be equipped with guard rails (see Chapter 8).

3. **Suspended Type** [illegible]spended staging, all lines should be [illegible]ected daily. Chafing gear should be [illegible]here lines are in contact with metal [illegible]ee Chapter 8 for use of suspended [illegible].

4. **Bumpers.** Bumper [illegible] spawls should be used to hold the staging away from the

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work (approximately 12 inches). Staging should be arranged for convenience and ease in adjusting height.

5. **Lifelines.** Lifelines should not be attached to suspended staging but should be secured from a rigid point.

1329. MACHINE OPERATION

1. **Changing Tanks.** Open and close valves in proper sequence to change over from an empty abrasive tank to a full one. Bleed out the air in the tank before refilling. Reestablish the air pressure after refilling with abrasive.

2. **Tending Control Valves.** Make sure that during blasting the valves are adequately tended in order to maintain proper mixture of abrasive and liquid. Be alert to close valves promptly if danger develops.

3. **Compressed Air Equipment.** Accumulators, filters, and/or water separators used with compressed air must be constructed and tested in accordance with code for pressure vessel as outlined in Chapter 7.

1330. HIGH PRESSURE AIR FLASKS

Special care must be taken when sandblasting operations are performed in the vicinity of high pressure air flasks. In order to prevent injury to personnel and damage to equipment, air flasks and associated piping in submarine tanks shall not be charged while sandblasting is in progress. The air flasks and piping shall be bled down and secured before sandblasting operations are commenced. Sandblasters shall be instructed in the precautions necessary to avoid damaging high pressure air system with sandblasting equipment.

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J-M 83

MT-PWHD-005474

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J-M 83

72 A number of incidences occurred where important documents were not given to MANNING or were sent to the wrong department."Breakdown in routing"

74 Time lag between the time that things reached shipyard commander and time they reached MANNINGs desk was indefinite

77 NAVSHIPS requested NAVSHIPS material. Was turned over to C. Turner who wrote report, gave it to MANNING to look over and then gave it to shipyard cammander for routing

78 NAVSHIPS visited 6-23-69--recommended extensive use of respirators

81 Foundry foreman requested inspection 6-27-69

82 Foreman was trying to substitute asbestos for a prior, ineffective method of cooling hot caps

82 Foreman had bought 100% asbestos fiber outside the shipyard and was trying to apply it it hot caps

82 MANNING told him to stop using fiber.

83 Foreman had no prior knowledge of the dangers involved

85 Discusses Beneficial Suggestion program--- employees are monetarily rewarded for submitting suggestions that might be helpjul in either reducing costs or reducing health hazards

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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

FILE COPY

WALTER C. RIGSBY, JOSEPH K. KLOSE and SHELDON H. MANNING,

Plaintiffs,

vs.

JOHNS-MANVILLE, etc., et al.,

Defendants.

No. C 151 947

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J-M 83

EXHIBIT III

EXHIBITS TO THE DEPOSITION OF SHELDON H. MANNING, VOLUME VI, taken Tuesday, March 6, 1979, at Los Angeles, California, before Lucia Moskal, CSR, a Notary Public.

3 OF 3

Reported by:
Lucia Moskal, CSR 1222

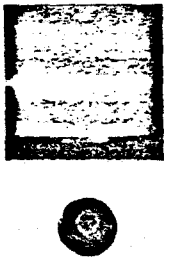
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J-M 83

CHAPTER 14



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Chapter 14

PORTABLE TOOLS

HAND TOOLS

1401. DEFINITION

The term tools as used in this section shall be understood to mean any small tool or device normally operated by hand.

1402. GENERAL PRECAUTIONS

1. **Standards.** All tools shall conform to Navy standards as to quality and type, and shall be used only for those purposes for which they were intended.

2. **Good Repair.** All tools in active use shall be maintained in good repair, and all damaged or nonworking tools shall be turned in to the toolkeepers.

3. **Authorized Personnel.** No tools shall be issued to or used by personnel not authorized to use them.

4. **Dressing Tools.** Toolkeepers shall issue only those tools they know to be safe. No shock tool with a mushroom head shall be permitted to leave the tool room; all cold chisels, chisel bars, cutters, or other shock tools with chipped, cracked, or mushroomed heads shall be dressed in accordance with standard practice before they are issued.

5. **Protection of Edges.** Toolkeepers shall give particular attention to keeping the jaws of wrenches in good condition, keeping sharp edged tools sharp, and protecting the sharp edges while tools are in storage.

6. **Ammunition or Explosives.** On work involving ammunition or exposed explosives, only tools specified in Bureau of Naval Weapons publications pertaining to the ammunition or explosives shall be used.

7. **Inspection.** Portable electric and pneumatic tools shall be kept in the best possible condition, with frequent checking of switches and control valves, electric cord and hose connections.

8. **Temper.** If a tool shows signs of being improperly tempered, the toolkeeper shall withdraw it from service, find the trouble, and have it corrected.

9. **Grinding Wheels.** If a grinding wheel has been abused, the toolkeeper shall give it the "ring test." Toolkeepers should know the safe speeds for abrasive wheels and how to mount and adjust them. Grinding wheels shall be stored in such a manner that mechanical shock will be held to a minimum.

10. **Sharp Tools.** Sharp edged tools shall not be carried unsheathed in tool bags, tool boxes, or in clothing pockets.

11. **Plastic Handles.** Plastic tool handles shall be of the non-flammable type.

1403. AXES, ADZES, HATCHETS

1. **Inspection.** Axes, adzes, and hatchets shall be inspected before being used; the handle shall be tight in the head, sound, and uncracked; blades shall be sharp and free of defects.

2. **Direction of Cut.** Cuts made with any tool having a cutting edge shall be made in a direction away from the body whenever possible.

3. **Protection of Fellow Workers.** No one shall work with an axe, adze, or hatchet without first making certain that all fellow workers are at a safe distance. No one shall cut toward a fellow worker.

4. **Passing Handle First.** In passing a tool to someone else, the worker shall pass the handle first, keeping a firm grip on the

1869

MT-PWHD-005479

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head until the other person has a secure hold on the handle.

5. **Stowage.** Sharpened tools are to be stowed so that their edges will be protected and will not endanger personnel.

1404. BRACES AND BITS

1. **Good Condition.** The jaws of the brace chuck shall be kept in good condition, the gripping edges sharp and clean. Bits shall be kept well sharpened and clean.

2. **Tightening Chuck.** A wrench or pliers shall not be used to tighten the chuck of the brace.

3. **Bit Firmly Gripped.** The bit shall be firmly gripped in the brace.

4. **Bit Breaking Through.** Care shall be exercised to prevent the bit from suddenly breaking through the material being worked.

1405. CHISELS, PUNCHES, DRIFT PINS

1. **Condition.** A burred chisel or a hammer with a mushroomed head shall not be used. If a cold chisel is not properly tempered or sharpened for the job or the head not properly chamferred, or if defective in any way, it shall not be used.

2. **Holding Chisel.** Cold chisels shall be held in the safest way possible—between the thumb and other four fingers; on horizontal cuts the palm should be up.

3. **Protection from Flying Chips.** Goggles shall be worn by persons using cold chisels. Other persons nearby shall wear goggles or shall be protected from flying chips by screens erected around the work.

4. **Handles of Chisels.** Handles of wood chisels shall be free of cracks and other defects and shall not be mushroomed. Wood handles should be fitted with a 1/2 to 3/4 inch wide metal band to prevent splitting.

5. **Cupping Chisel in Palm.** When cutting by hand with a wood chisel, the chisel handle shall be cupped in the palm of the hand and pressure exerted away from the body.

6. **Making Cut.** All cuts shall be made away from the body.

7. **Working Close to Others.** Care shall be taken that no other person is close enough to be injured if the chisel should slip or get away from the user.

8. **Punches and Drift Pins**

a. **Condition.** Punches and drift pins shall be kept in good condition and shall be properly tempered and dressed.

b. **Strike Sharply.** Punches and drift pins shall be struck sharply and squarely; they shall be held firmly.

1406. DRILLS

1. **Condition.** Only straight, undamaged, and properly sharpened drills shall be used.

2. **Chuck.** The chuck shall be tightened securely with the key provided. Wrenches or pliers shall not be used on any chuck. Drill shall be straight and true in chuck.

3. **Work Firmly Clamped.** The work shall be firmly clamped and, if of metal, a center punch shall be used to score the material before the drilling operation is started.

1407. FILES, RASPS

1. **Handles.** Every file or rasp shall be equipped with a securely-fitted, substantial handle.

2. **Filing Close to Chuck.** Filing work close to the chuck in a lathe shall be done left-handed.

3. **Striking Rasp.** A file or rasp shall never be hit. It shall be tapped gently against a block of wood to clear it. A steel wire brush should be used to clean files.

4. **Prohibited Uses**

a. An old file or rasp shall not be used to make a punch or chisel.

b. A file shall never be used as a pry or lever.

5. **Carrying Files.** No one shall carry a file about his person without a handle over the tang.

1870

MT-PWHD-005480

REDACTED
J-M 83

6. **Steadying End of File.** The file should always be used with one hand grasping the handle and the other steadying the end of the file.

7. **Holding Against Material.** Files and rasps should be held against the material only on the cutting stroke, never on the return.

8. **Selection of File.** The correct file shall be used for the job; a fine file for fine work, a coarse file for coarse work.

1408. HAMMERS

1. **Selection of Type.** Care shall be used in selecting a hammer suitable for the job. The head shall be wedged securely and squarely on the handle and neither the head nor the handle shall be chipped or broken.

2. **Free of Grease.** The hammer shall be kept clean and free from oil or grease which might cause the handle to slip from the hands or cause the face of the hammer to glance from an object being struck.

3. **Striking.** The handle of the hammer shall be grasped firmly near the end, the eye kept on the point to be struck, and a true blow struck with the hammer face, which is hardened for this purpose. The hammer face shall not be damaged by striking steel harder than the face itself.

4. **Tool Holders.** In using sledge hammers to strike chisels or other similar shock tools, the workman holding the tool shall be provided with a tool holder so that in case the sledge misses the tool, it will not strike the holding workman.

5. **Drawing Nails.** When nails are being drawn with a hammer, after the nail is partly drawn, a piece of wood should be placed under the hammer to increase leverage and reduce the strain.

1409. PIPE CUTTERS

1. **Free of Dirt.** The pipe cutter shall be kept free of chips and dirt.

2. **Oiling.** The cutter shall be oiled frequently while the cut is being made.

3. **Pressure on Wheel.** No wrench, pliers, or other tool shall be used to increase the pressure on the movable wheel.

4. **Method of Cutting.** When a cut is being made, the employee shall cut a short way, then back off to tighten the wheel, and then cut again.

5. **Supporting Pipe.** The end of any long pipe shall be supported during the cutting operation.

6. **Removing Burr.** After the cut is completed, the burr shall be removed from the pipe with a file or reamer.

1410. PLIERS, SIDE CUTTERS, DIAGONAL CUTTERS

1. **Selecting Tool.** Care shall be used in selecting the correct plier or cutter for the work to be performed.

2. **Correct Tool.** Pliers or cutters shall not be used on nuts, pipe fittings, etc. The wrench designed for that particular job shall be used.

3. **Condition of Tools.** The tool shall be kept free from grease and oil and the teeth or cutting edges shall be kept clean and sharp. The fulcrum pin, rivet, or bolt shall be properly oiled and shall be snug but not tight.

4. **Cutting Short Pieces.** When cutting short pieces, take care that they do not fly and cause injury. Protective eyewear shall be worn when cutting short pieces.

5. **Extensions on Handles.** Extensions on the tool handle to increase leverage is prohibited.

6. **Protection of Fingers.** Fingers shall not be wrapped around the handle of a tool in such a way that they can be pinched or jammed if the tool slips from the work.

1411. SAWS

1. **Cutting Across or with Grain.** Only saws that are sharp and properly set shall be used. A crosscut saw shall be used for cutting across the grain; a ripsaw for cutting with the grain.

0008 1163

REDACTED
JM 83

2. **Guiding Cut.** The saw shall be guided with the free hand when starting the cut; only one or two long, slow cuts upward shall be taken and then the hand shall be removed from the danger zone before the sawing is continued.

3. **Line With Cut.** The saw blade shall be kept in direct line with the cut.

4. **Sticking Saw.** If the saw sticks in wet or gummy wood, a small amount of oil or paraffin may be applied. In severe cases, a wedge may be used to hold the cut open.

5. **Operator's Balance.** The employees shall take care not to be thrown off balance when using one knee to steady the material being sawed.

6. **Hack Saws.** Hack saws should be adjusted in the frame snug and tight enough to prevent buckling. The number of teeth per inch should be selected for the work: 14 for soft, solid metal; 18 for hard metal and general use; 24 for drill rods, short metal, and tubing; and 32 for thin sheet metal and tubing. Pressure should be on the down stroke only, lifting slightly on the back stroke. Twisting the blade or exerting excessive pressure should be avoided.

1412. SPADES, SHOVELS, PICK-AXES

1. **Inspection.** Before the tool is used, it shall be inspected by the worker to be sure that it has a strong, smooth handle and grip free from splinters, checks, and splits, and that the blade is smooth, sharp, and free from twist.

2. **Clearance.** There shall be adequate clearance between men using shovels so that no one will be struck by either tools or material.

3. **Use of Foot.** The area of the ball of the foot, not the instep area, shall be used to press the tool into clay or other stiff material.

4. **Reducing Body Strain.** Unnecessary strain should be avoided by using the leg muscles as much as possible in digging and lifting loads, by being sure of footing, and by keeping the body balanced as much as possible.

5. **Handing Tools.** Tools shall never be thrown or tossed to another person, but shall be handed to him with the handle forward.

6. **Leaving Tools.** A tool shall never be left where personnel may stumble over it or strike against it; it shall be hung up or placed in the corner; the blade of spades and shovels should be struck securely in the ground.

1413. SCREWDRIVERS

1. **Size.** Care shall be taken to select a screwdriver of the proper size to fit the screw.

2. **Handle.** No screwdriver with a split or splintered handle shall be used.

3. **Starting Screw.** An awl auger drill having bit or driver nail shall be used to start each screw.

4. **Point.** The point of the screwdriver shall be kept in proper shape with a file or grinding wheel.

5. **Working from Ladder.** The worker shall be well braced before driving screws from a ladder (see Chapter 8).

6. **Correct Use.** A screwdriver shall not be used as a substitute for a punch, chisel, nail puller, etc.

7. **Electrical Work.** Only screwdrivers with insulated handles shall be used for electrical work.

1414. THREADING DIES

1. **Free of Dirt.** Dies shall be kept clean and free of chips and dirt.

2. **Chipped or Burred Edges.** No dies with chipped or burred edges shall be used.

3. **Clamped to Stock.** The die must be firmly clamped to the stock.

4. **Cutting Operation.** The cutting edges shall be oiled before and during the cutting

1872

MT-PWHD-005482

0008 1164
REDACTED
J-M 83

operation. Die shall be backed off a part turn every second revolution.

5. **Hand Die Stock.** When a hand die stock is being used, care shall be taken by the operator to avoid straining himself.

6. **Stowing.** The die and stock shall be thoroughly cleaned and put away after use.

1415. WHETSTONES AND STEELS

1. **Free of Dirt.** Whetstones and oil stones shall be kept free of dirt and cracks.

2. **Guiding Tool.** One hand shall guide the tool while it is being sharpened on the stone.

3. **Guards.** Stones and steels shall be equipped with guards, wherever possible.

4. **Direction of Stroke.** All strokes should be made away from the body.

5. **Block or Spacer.** A stone shall not be used in place of a block or spacer.

6. **Use of Steel.** A steel shall never be used as a pry, chisel, or bar.

1416. WRECKING BARS, CROWBARS

1. **Sharp and Free of Burrs.** Wrecking bars and crowbars shall be kept sharpened and free from burrs.

2. **Slipping.** Care shall be taken that the bar does not slip and cause injury to fellow workers.

3. **Pulling Nails.** When nails or screws are being pulled, wrecking bars shall have a block placed under the jaws after a long nail or screw has been started; this takes some of the strain off the jaws and increases the leverage.

4. **Striking Bar.** Wrecking bars shall never be struck with case-hardened steel tools. Wood, plastic, or soft steel objects shall be used for striking purposes.

1417. WRENCHES

1. **Selection of Wrench.** Care shall be used in the selection of the right wrench for the job; an extension shall never be used on a wrench. Box or socket wrenches are recommended where heavy pulls are required since there is always the danger of slipping or jaws springing in using open-end wrenches. Open-end wrenches are satisfactory for medium duty work.

2. **Condition.** Only wrenches in good condition shall be used; a bent wrench, if straightened, has been weakened and shall not be used.

3. **Strain.** A small wrench should not be overstrained. No wrench should be subjected to severe side strain.

4. **Pulled.** A wrench shall always be pulled toward the operator, never pushed, since it is easier to brace against a backward pull than against a sudden lunge forward should the tool slip or break.

5. **Use as Hammer.** No wrench shall be used as a hammer.

6. **Machine in Motion.** A wrench shall never be used on material in a machine in motion; the machine shall be stopped to permit working on the stock.

7. **Adjustable Wrenches.** An adjustable wrench shall be faced so that the movable jaw faces in the direction in which the handle is turned. The bite of a pipe wrench shall be taken near the middle of the jaws so there will be teeth in front if the wrench slips; the teeth shall be kept sharp.

8. **Sledge-type Wrench.** Only a sledge-type wrench especially tempered for use with a sledge should ever be struck or hammered to loosen nuts or bolts.

9. **Working in Confined Space.** There shall be adequate clearance between the worker and the wrench; in tight places the worker shall take care that the grip he uses will not endanger him.

1418. MACHETE, SCYTHE, SICKLE, BOLO

1. **Protection of Cutting Edges.** The cutting blades of these tools shall be sheathed, racked, or otherwise protected while being carried or during storage.

MT-PWHD-005483

2. **Condition.** The tools shall be kept sharp and handles should be in good repair.

3. **Clearance.** Ample clearance (a distance beyond the maximum possible swing) from other employees shall be maintained.

4. **Stroke.** Exceptional care shall be taken by persons using these tools that all strokes are made away from the body and particularly from the legs, feet, and the free hand when using the machete, sickle, or bolo.

5. **Intended Purpose.** The tools shall be used only for their intended purpose, i.e., the cutting of weeds, underbrush, and similar vegetation.

REDACTED J-M 83

PORTABLE POWER TOOLS

1425. GENERAL PRECAUTIONS

1. **Inspection.** Portable power tools shall be kept cleaned, oiled, and repaired. They shall be carefully inspected before use. The switches must operate properly and the cords be clean and free of defects. The plug shall be clean and sound.

2. **Grounds.** The casings of all electrically driven tools shall be grounded. Double insulated tools from sources qualified under the applicable military specification are exempt from this grounding requirement (see 1512).

3. **Fire Hazard.** Sparking portable electric tools shall not be used where flammable vapors, gases, liquids, or exposed explosives are present.

4. **Care of Cords**

a. **Danger of Being Cut.** Care shall be taken that cords do not come in contact with sharp objects; they should not be allowed to kink, nor left where they might be run over.

b. **Grease or Chemicals.** Cords must not come in contact with oil or grease, hot surfaces, or chemicals.

c. **Patching Prohibited.** Damaged cords shall be replaced. They are not to be patched with tape.

d. Stowage. Tools shall be stored in a clean, dry place where the cord can be loosely coiled.

1426. POWER TWIST DRILLS

1. **General.** Precautions for hand drills as given in article 0918 are also applicable to power twist drills. In addition, the following requirements shall be met:

a. **Drill Firmly Grasped.** A portable power drill shall be grasped firmly during the operation to prevent it from bucking or breaking loose, thereby causing injury or damage.

b. **Cleaning.** When the work is completed, the drills shall be removed, and drill and motor shall both be well cleaned.

1427. PNEUMATIC TOOLS

1. **Protective Apparel.** Operators using this type of tool shall wear and use necessary personnel protective devices.

2. **Authorized Personnel.** Only authorized and trained personnel shall operate pneumatic tools. Personnel with arthritis, neuritis, or circulatory disease shall not use vibrating tools such as hammers, chisels, tempers, riveters, or corkers.

3. **When Not in Use.** Pneumatic tools shall be laid down in such a manner that no harm can be done if switch is accidentally tripped. No idle tool shall be left in a standing position.

4. **Inspection.** Pneumatic tools shall be kept in good operating condition, thoroughly inspected at regular intervals with particular attention given to control and exhaust valves, hose connections, guide clips on hammers, and the chucks of reamers and drills.

5. **Relieving Pressure.** Pressure shall be shot off and exhausted from the line before disconnecting the line from the tool.

MT-PWHD-005484

0008 1 REDACTED J-M 83

6. **Air Hose.** The air hose shall be suitable to withstand the pressure required for the tool. Leaking or defective hose shall be removed from service. Hose shall not be laid over ladders, steps, scaffolds, or walkways in such a manner as to create a tripping hazard. Where hose is run through doorways, the hose shall be protected against damage by the door edge.

7. **Compressed Air.** Compressed air shall not be used to clean clothing being worn or to blow dust off the body. An air hose shall never be pointed at other personnel. (See article 0902.3.)

1428. PNEUMATIC ROCK DRILLS

1. **Apparel.** Under no circumstances shall the operator of portable pneumatic drills wear loose or torn clothing. Only trained competent personnel, wearing necessary protective devices, shall operate drills.

2. **Defective Bits.** Bits shall be examined for defects; particular attention shall be paid to bit flutes which shall be ground to uniform size, sharpness, and length.

3. **Alignment.** Machine shall be held on a straight line with the hole being bored. Tipping of bit is prohibited.

4. **Speed.** Machine shall not be fed too fast.

5. **Firm Footing.** Operator shall be on firm footing before commencing operation.

6. **Hand-Grip Switch.** All drills shall be equipped with a hand-grip switch that will shut off the supply of air when grip is released. This switch shall not be modified or by-passed in any manner without prior approval of the safety engineer.

1429. POWER HAMMERS

1. **Pointing Hammer.** No employee shall point any pneumatic hammer at other personnel. Hammers shall be operated in a careful and safe manner at all times.

2. **Tool Holder.** All hammers shall be equipped with a device for holding the tool in the machine. These safety tool holders shall be inspected at frequent intervals.

3. **Air Exhaust.** Operators shall not restrict the air exhaust port in any fashion.

4. **Hand-Grip Switch.** All pneumatic hammers shall be equipped with a hand-grip safety switch. (See article 1428.6).

5. **Limit of Use.** Hammers shall be used only for those purposes for which intended.

6. **Protective Apparel.** All hammer operators shall wear necessary eye, face, and body protection. Operators of pneumatic hammers should wear gloves.

1430. POWER WRENCHES

1. **Correct Use.** Pneumatic wrench operators shall use a wrench only for those purposes for which it is intended.

2. **Hand-Grip Switches.** All wrenches shall be equipped with hand-grip safety switches.

3. **Inspection.** All wrenches shall be inspected frequently by competent personnel.

4. **Loose Clothing.** Operators of pneumatic wrenches should not wear loose fitting articles of clothing.

5. **Protective Devices.** Wrench operators shall use all protective devices provided.

1431. POWDER ACTUATED TOOLS

1. **Authorization for Use.** Powder actuated tools shall be operated, repaired, serviced, and handled only by personnel who have been trained and certified by the manufacturer, his authorized representative, or Navy Department certified instructors. In applications to concrete, approval for use of the tool shall be given only after it has been ascertained that it will give satisfactory results and create no spalling or "shelling-out."

2. **Safeguards Against Misuse.** Such supervision as necessary, including the following provisions, shall be provided to forestall the use of these tools by unauthorized persons:

1875

MT-PWHD-005485

0008 1167 REDACTED J-M 83

a. Authorization. To secure authorization to operate a powder-actuated tool, the operator will present his application to the designated representative for issuance and recording of a work site permit.

b. Tool Permit. Each powder-actuated tool to be used at the work site will be presented to the designated representative for inspection and registration. If acceptable, a tool permit will be issued prior to use at the work site.

(1) *Data Required.* For each powder-actuated tool registered, the following data will be obtained and recorded: trade name; manufacturer; model and size; serial number; ownership.

(2) *Flammable Areas.* The use of powder-actuated tools in explosive or flammable atmospheres is prohibited.

3. **Head and Eye Protection.** The tool operator, together with other personnel in the vicinity, shall wear safety goggles or other approved safety-type face and eye protective devices and a hard hat.

4. **Securing of Tools.** Powder-actuated tools and the powder charges will be secured to prevent unauthorized possession.

5. **Tool Deficiencies.** Upon the detection of any defect in the operation of a powder-actuated tool, the tool will be removed from service until the deficiency is corrected.

6. **Charging Propellant.** Powder-actuated, fastener-type tools which, by means of a powder charge propellant, discharge an object for the purpose of affixing it to or penetrating another object, will meet the following requirements:

a. Protective Shield. The muzzle end of the tool, including barrel extensions, shall have a protective shield or guard at least 3 inches in diameter, securely attached, perpendicular to the barrel, designed to confine the flying particles and arrest the ricochet of the projectiles; or, in lieu of such shield or guard, a jig providing equivalent protection may be used.

b. Protective Securing Measures.

(1) The tool shall be made incapable of firing if [illegible] standard guard [illegible] fixture, or jig of the ma[illegible]

(2) [illegible] operated against other tha[illegible] unless it is equipped wit[illegible] jig to accommodate the cu[illegible] of the surface.

(3) The tool shall be so designed that it will not operate when equipped with the standard guard in [illegible] position, if the bearing [illegible] of the guard is tilted more than eight degrees from contact with the work surface.

7. **Affixing Fasteners.** Fasteners shall not be driven directly into materials such as brick or concrete closer than 3 inches from the edge or corner, or into steel surfaces closer than one-half inch from the edge or corner, unless a special guard, fixture, or jig is used. Penetration must not endanger personnel, equipment, materials, or surroundings on the opposite side of the object to which the fastener is being affixed.

8. **Compliance With Authorities.** All powder-actuated tools and their use will comply with such Federal, State and local laws as are applicable.

1432. POWER SAWS

In addition to the general precautions for portable electrical and pneumatic tools contained in this chapter, the precautions common to both electrical and pneumatic portable saws are as follows:

1. All circular portable power saws shall be provided with guards that fully encompass the unused portion of the blades.

2. Circular saw blades shall be installed by qualified personnel and only when the source of power is disconnected from the tool.

3. Only a hand grip switch, electric or pneumatic, shall be used.

1433. BUFFERS AND ABRASIVE GRINDING WHEELS

The applicable precautions of articles 0926 and 0927 shall be followed.

1876

MT-PWHD-005486

0008 1168

REDACTED
J-M 88

CHAPTER 15



1877

0008 1169

REDACTED
J-M 83

Chapter 15

ELECTRICITY AND ELECTRONICS

GENERAL

1501. PERSONAL PROTECTION

1. **Safety Instructions.** Personnel engaged in electrical work are to be fully informed of the hazards involved. They shall receive proper instruction in accident prevention and first-aid procedures. Procedures prescribed in NAVDOCKS MO-200, *Electric Power Distribution Systems Maintenance*, shall be observed.

2. **Clothing**

a. **General Safety Measures**

(1) Do not work on electrical apparatus with wet hands or while wearing any wet clothing.

(2) When performing work on or within four feet of exposed electrical equipment, do not wear any clothing with exposed zippers, buttons, or other metal fasteners.

(3) Personnel shall wear no loose or flapping clothing.

(4) Flammable articles, such as celluloid cap visors, shall not be worn.

(5) Personnel shall remove rings, wrist watches, bracelets, and other similar metal items before performing work on or within four feet of electrical equipment with exposed current-carrying parts.

(6) Personnel performing line construction and maintenance work shall wear high-cut shoes with sewed soles for work on live electrical circuits where the voltage is above 50 volts. Thin soled shoes and shoes with metal plates or hobnails are prohibited. Safety shoes with nonconductive soles shall be worn if available.

b. **Special Protective Clothing**

(1) *Rubber Gloves.* Rubber gloves should be worn by personnel likely to come in contact with live conductors or current-carrying parts of equipment in the course of their work where the system voltage exceeds 30 volts. Since circuits below 30 volts are also dangerous, no work should ever be done on live conductors of any voltage except in case of emergency. If the work requires that one hand be free of covering, a rubber glove should be worn on the other. The following safety rules shall apply in the use of rubber gloves:

(a) Personnel intending to work on live circuits, or on equipment containing exposed current-carrying parts where the voltage exceeds 30 volts, shall put on rubber gloves before coming within reach of the live parts and shall not remove them until entirely clear of such equipment. Rubber gloves shall not be used for any purpose except live line work.

(b) Leather protectors shall always be worn over rubber gloves. Leather protectors shall not be used for any purpose other than with rubber gloves.

(c) Rubber sleeves or rubber gloves shall never be rolled down or worn inside out. Under no circumstances shall two pairs of rubber gloves be used.

(d) Personnel shall wear rubber gloves when cutting a supposedly dead cable or testing supposedly burned-out transformers.

(e) Rubber gloves shall be tested periodically as prescribed in article 1501.2b (2). In addition, before each use, they shall be checked by the user for punctures, tears, or abrasions. Cuffs should be rolled up and air forced into the fingers and palms of the gloves. If there is evidence of any leakage or thin spots, the gloves should not be used.

(2) *Testing Rubber Protective Equipment.* Rubber gloves and other rubber

1878

MT-PWHD-005488

0008 REDACTED J-M 83

protective equipment shall be tested at intervals not to exceed the following when in regular use except as further prescribed herein:

Rubber Gloves	30 days
Rubber Blankets	90 days
Rubber line hoses, and hoods	180 days

Electrical tests, testing equipment, and method of marking shall be in accordance with current ASTM standards.

Each glove or other piece of rubber protective equipment shall be provided with a rubber calendar on which shall be marked with an electric pencil the last date on which the item was tested and passed. Equipment failing to pass the test shall be replaced. Tests will be made by naval activities having the necessary equipment, by reputable electrical testing laboratories, or by local power companies which may have such testing equipment and are willing to perform such tests. See also NAVDOCKS MO-200, *Electric Power Distribution Systems Maintenance*.

All rubber protective equipment shall be given a thorough visual inspection and an electrical test whenever the last test was made more than six months prior to issue or delivery for actual use of personnel. Equipment maintained in a standby status for emergency use only, may be considered to be in the same category. If it has been used more than six weeks but less than six months after the last test, it shall again be tested before being returned to standby status or placed in regular use.

(3) *Protective Helmets.* Regular protective helmets (hard hats) are required to have a degree of insulation resistance such that personnel other than electrical may be protected from accidental head contacts with electrical circuits and equipment at comparatively low voltages (less than 2200 volts). Electrical workers requiring head protection incidental to their duties or to the working environment particularly those engaged in transmission or distribution line installation and repair, shall wear electrical workers insulating safety helmets or all-purpose protective helmets for which the proof-test voltage is not less than 20,000 volts.

(4) *Defective Personal Equipment.* Personal protective equipment should be frequently inspected by the wearer. Equipment found defective shall be immediately taken out of service, tagged, and turned in for repair or replacement.

3. Insulating Floor Covering. On all circuits where the voltage is in excess of 30 volts, the worker shall be insulated from accidental grounding by use of approved insulating material on the floor at operating and working locations. The material shall have the following qualities:

a. It shall be dry, without holes, and shall not contain conducting materials.

b. The voltage rating for which it is made shall be clearly marked on the material, and the proper material shall be used so that optimum protection from the voltage can be supplied.

c. On voltage below 600 volts, dry wood may be used, or, as an alternative, at least two layers of dry canvas, sheets of phenolic material, or rubber mats. Where other than approved rubber mats are used, the marking provision of paragraph b above shall not apply; however, care shall be taken to insure that substitute material is capable of providing the required insulation value.

d. On circuits above 600 volts, nonconducting rubber matting of an approved type shall be used.

e. Care shall be exercised to insure that moisture, dust, metal chips, etc., which may collect on insulating materials is removed at once. Small deposits of such materials can become very great electrical hazards.

4. Platforms. Whenever it is necessary to work on electrical circuits or equipment in wet or damp locations, dry wooden (or similar nonconducting material) platforms shall be provided so that there will be no possibility of contact between the wet floor and the workmen's shoes.

5. Metal Tool Handles. Meter testers, relay men, and servicemen may work on energized equipment where rubber gloves cannot

1879

MT-PWHD-005489

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LBNS SAFETY SUPPLEMENT NO. 1500

J-M 83

Subj: Safety Precautions Relative to Electricity

Ref: (a) NAVMAT P-5100, Chapter 15

1. PURPOSE: To supplement reference (a) with precautions concerning safe electrical work practices and procedures.

2. ACTION. The following safety precautions supplement the corresponding article in reference (a).

a. Article 1501.2.b.(1), Rubber Gloves. Employees who are involved in electrical operations will obtain and use the proper type of rubber gloves. Many workers do not appreciate the importance of using the proper type of rubber gloves when they are handling electrical circuits and apparatus. In the manufacture of linemen and electrical workers' rubber gloves, care is taken to assure the greatest possible protection for the user. Gloves for this purpose are made only from first quality natural rubber. The gloves are required to withstand a voltage of 25,000 (RMS), but this does not mean it is safe to use them on such high voltages. Linemen and electrical workers' gloves should never be used on circuits exceeding 5,000 volts to ground. It should be remembered that fatalities or serious injury have occurred even though the difference in potential is low. Many fatalities have occurred by contact with the ordinary 115 volt, 60 cycle current.

(1) Procurement and issue. The procurement of linemen and electrical workers' rubber gloves is the responsibility of the Production Department (Code 906). These items will be issued from the Safety Issue Section in the same manner as any other tool. Linemen electrical workers' rubber gloves will be issued and used only by Shops 03, 51, 67 and 99.

(2) Care and storage.

(a) Proper care of gloves is very important. If they are cared for properly, they will last for many years. If they are not well taken care of, they may deteriorate rapidly and become unsafe for use in electrical work. The gloves should not be exposed to oils and grease, and leather gloves should be worn over rubber gloves to protect them against abrasion, cuts, and snags.

(b) Rubber gloves will be kept in an appropriate plastic container which has been sealed, dated and signed by a Laboratory inspector. They will be stored in a cool, dark place, since both heat and light are detrimental to rubber. They should not be stored close to high tension electric apparatus because the ozone generated by such apparatus is harmful to rubber.

MT-PWHD-005490

REDACTED 83

(3) Inspection and test. It will be the responsibility of the Quality Assurance Office Laboratory Division (Code 134) to examine carefully each glove from the following sources for abrasions, cuts, or snags, and test for leakage current: Those which are

(a) Acquired from the Naval Supply Center;

(b) In Shop 06 storage for more than six months;

(c) Returned after each usage.

The date and year of each test as well as the inspector's signature will be affixed to the plastic container for each glove in addition to markings required by MILSPEC MIL-G-16371.

b. Article 1511.3, Tagging of Equipment. When work is to be performed on any electrical equipment a DANGER TAG will be placed on all switches, fuse boxes and other switch gear controlling the flow of energy to such equipment, in accordance with Supplement No. 0115.

(1) It is expressly forbidden for any employee, other than the one placing the tag, to remove it or in any way change the tagged switch without the approval of the supervisor of the employee who originally placed the tag in effect, and then only in the event the tagging employee is absent from the job.

(2) It is also expressly forbidden for anyone to energize a circuit which has been tagged out in accordance with these instructions and from which circuit the tag has not been removed.

(3) Prior to undertaking of tests of electric circuits which have been tagged out, the crew performing the test will insure that work has been completed and that no hazard will result by energizing the circuits.

c. Article 1513, Portable Electric Equipment. All personnel who use electrically powered portable tools will be instructed in their safe use, and only qualified employees will operate this type equipment. Operators will be instructed and cautioned about the mishandling, improper use of, and striking of moving parts or dropping of tools that may injure and make the tool defective. No portable electric hand tools will be altered, tampered with, or have the safety guard removed after issue, and tools issued to one shop will not be loaned to employees of another shop without permission of the supervisors of both shops.

MT-PWHD-005491

REDACTED
J-M 83

(1) Issuance. Each tool room attendant issuing electrically powered portable tools will, prior to each issue, insure that the tool is properly grounded and is in good operating condition. Equipment which fails to meet the requirements, either as to safety or operating condition, will be forwarded promptly to Shop 06, Building #136, for repair before issuance.

(a) No tools will be issued when the equipment ground wire is not clearly identified.

(b) Electric grinder and wire wheels must be equipped with adequate wheel guards.

(c) Electric hand tools used for grinding will be marked with the RPM of the tool so proper speed can be selected when mounting grinding wheels.

(2) Grounding portable electric tools. All electrically powered portable tools issued for use on board ship or in shops will have a ground wire attached (either by external connection with ground clamp or connected by spare wire in three-prong half plug). The grounded service conductor (neutral) will not be used as an equipment ground. The supervisor will check and instruct each employee using portable electric tools to insure he has sufficient knowledge concerning the proper grounding and safe operation of the equipment. (See Article 1512 for grounding precautions.)

d. Article 1514, Switches and Circuit Breakers.

(1) Where work in the immediate vicinity of or handling of material past a switchboard presents a danger of personnel or material coming into contact with the board, a plywood or other suitable barrier will be installed in front of and/or behind the switchboard prior to the commencement of work and during operations, as conditions warrant. This barrier will be installed so that there is easy access to the board in case of emergency when a switch must be opened or closed.

(2) No material, tool boxes, or other articles will be stowed in front of or behind the main or auxiliary switchboard so that they obstruct free passage.

e. Article 1525, Working on Energized Circuits. Before employees start to work on energized switchboards, supervisors will instruct them where the power can be shut off. In addition, all necessary safety guards and equipment will be obtained before starting work on energized panels that the supervisor considers must be maintained in an energized condition.

MT-PWHD-005492

0008 1174
REDACTED
J-M 83

(1) No less than two competent men will be assigned to work on energized main or auxiliary switchboards.

(2) No work will be performed behind energized switchboards without specific authority of the immediate supervisor.

MT-PWHD-005493

REDACTED

J-M 83 Electricity and Electronics

be worn. In these cases insulated handles on tools are adequate. Metal handles of hand held tools shall be insulated by one of the following methods:

a. **Taping Method.** The handle and as much of the shaft as is practicable is covered with two layers of rubber or vinyl plastic tape half-lapped, followed with a layer of friction tape half-lapped.

b. **Coating Method.** Handle and shaft is dipped in a plastisol solution in accordance with the instructions of paragraph 9190.170 of *Bureau of Ships Technical Manual,* NAVSHIPS 250-000.

c. **Sleeve Method.** In an emergency, where time does not permit using one of the previous methods, handles and shafts may be covered with a cambric sleeving, flexible plastic tubing, or insulating tubing removed from scraps of electrical cable.

6. **Fuse Box Covers and Other Such Equipment.** The covers for fuse boxes, and other types of wiring equipment and accessories shall, except when work is being done on them, be kept securely closed and locked. When work is being done on such equipment, unauthorized personnel should be kept at least four feet away and warning signs posted to keep clear. If equipment must be left exposed and unattended, adequate safeguards such as a temporary nonconductive covering shall be installed.

7. **Metal Enclosures.** Protective metal enclosures for electrical and electronic equipment, metal bases, frames, etc., are to be grounded in accordance with article 1512. Grounding shall be checked at regular intervals and after repair work has been performed.

8. **Interlocks and Safety Devices.** Safety devices such as interlocks, overload relays, and fuses shall not be altered or disconnected except for replacement, nor shall safeguard circuits be modified without specific authority.

9. **Tools.** Unserviceable tools shall be repaired if possible or condemned and replaced. Tool handles, either wooden or plastic, which are cracked, chipped, splintered, or broken must be replaced. See also NAVDOCKS MO-200, *Electric Power Distribution Systems Maintenance.*

10. **Warning Signs.**

a. **Explosive Vapors.** Warning signs shall be temporarily displayed where explosive vapors are present in any compartment or space. No electrical or electronic equipment or auxiliary control units shall be energized within such area while these signs are posted.

b. **Open Circuits.** Warning tags requiring open-circuit condition shall be placed on all necessary power supply switches to prevent accidental application of power to units of an electrical or electronic system that are under repair or overhaul.

c. **Shops.** Appropriate warning signs shall be displayed in electrical, aviation, electronic, and special weapons shops.

d. **Permanent Signs.** Danger or warning signs shall be permanently posted in conspicuous places and suitable guards shall be installed in appropriate areas to prevent personnel from making accidental contact with antennas, antenna leads, power supply leads or terminals, fuses, or any uncovered contacts that have sufficient voltage and current characteristics to constitute a hazard to personnel.

e. **Drawings.** The following Bureau of Ships Drawing Standards have been prepared for warning signs:

High Voltage (RE 10 B 608B)
Stack Gases (RE 10 AA 529 A)
Explosive Vapors (RE 10 A 589 A)
R. F. Hazards (RE 10 D 2282)

11. **Special Precautions Against Electrical Shock.** Strict adherence to the rules on the use of proper clothing and equipment, outlined above, is essential in an area where electrical work is being done and serves as an aid to the prevention of electric shock. Other safety measures to be taken are as follows:

a. **Caution With Metal Parts.** It is essential that personnel also keep in mind the

1884

MT-PWHD-005494

REDACTED

fact that various pieces of equipment not ordinarily thought of as conductive can be dangerous. Miscellaneous tools and equipment containing metal parts, such as metal tapes, cloth tapes with embedded metallic threads, wooden scales with metal trimmings, cleaning brushes, dusters, or brooms having exposed metal parts, etc., shall not be used in any area within four feet of electrical equipment or wiring having exposed current-carrying parts.

b. Illumination. It is the responsibility of the supervisor to ensure that sufficient illumination is provided for safe and expeditious performance of work involving electrical wiring and equipment. See Chapter 2 for minimum lighting necessary for specified types of work.

c. Attention to Work. Personnel working on electrical circuits shall exercise extreme care to ensure that their attention does not wander and that attention is not diverted from the work at hand.

d. Accidental Grounds and Short Circuits. Continual inspection with awareness of the danger of accidental grounds and short circuits is necessary for the safety of personnel. Any dangerous conditions shall be reported and should be corrected if possible before any further work is done in the area.

e. Insulation. Do not trust insulation when electrical work is to be performed. Insulation may appear to be in perfect condition but, if defective, may result in serious injury from electric shock.

f. Live Circuits. Fundamentally, current, rather than voltage, is the criterion of shock intensity. The passage of even a very small current through a vital part of the human body will cause DEATH. The voltage necessary to produce the fatal current is dependent upon the resistance of the body, contact conditions, the path through the body, etc. When a 60 cycle alternating current, for example, is passed through a man from hand to hand or from hand to foot and the current is gradually increased from zero it will cause the following effects: at about 1 milliampere (0.001 ampere) the shock is perceptible; at about 10 milliamperes (0.01 ampere) the shock is of sufficient intensity to prevent voluntary control of the muscles and a man may be unable to let go and free himself; at about 100 milliamperes (0.1 ampere) the shock is fatal if it lasts for one second or more. The above figures are the results of numerous investigations and are approximate because men differ in their resistance to electrical shock. It is imperative to recognize that the resistance of the human body cannot be relied upon to prevent a fatal shock from 115 or lower voltages – FATALITIES FROM AS LOW AS 30 VOLTS HAVE BEEN RECORDED. Tests have shown that body resistance under unfavorable conditions may be as low as 300 ohms and possibly as low as 100 ohms from temple to temple if the skin is broken. Volt for volt DC potentials are normally not as dangerous as AC as evidenced from the fact that reasonably safe "let-go current" for 60 cycle alternating is 9.0 milliamperes for men and 6.0 milliamperes for women while the corresponding values for direct current are 62.0 milliamperes for men and 41.0 milliamperes for women. *Any circuit not positively grounded shall be considered live.*

(1) When working on live circuits exercise as much care to avoid contact with low voltages as with high voltages. Work on live circuits should not be undertaken alone and should be accomplished only in accordance with the procedures stated in article 1525. Circuits of 30 volts or less usually are considered safe from shock hazard but danger from the fire hazard, where high currents are possible, must be guarded against.

(2) Never take a shock intentionally from any voltage. This is dangerous practice and is strictly forbidden. Whenever it becomes necessary to check a circuit to see that it is alive, an appropriate voltage tester, voltmeter or other indicating device shall be used. Circuits carrying voltages in excess of 600 volts shall not be measured by probing or holding the test probes in the hands. Whenever measurements of voltages in excess of 600 volts are necessary, the procedures prescribed in article 1525 paragraph 3 shall be followed.

REDACTED
J-M 83

(3) Do not approach closer than one foot to any electrical circuit or any electrical equipment where the circuit voltage is below 7,500 volts and which has exposed live metal parts, except to accomplish a particular mission with respect to the circuit or equipment. Where the circuit voltage exceeds 7,500 volts, maintain clearances as tabulated in article 1525.4c(3).

g. Protection of Nonelectrical Workers. Where work is being performed within four feet from the exposed parts of electrical or electronic equipment by painters, carpenters, or other trades, regardless of the voltage an insulating barrier shall be provided between the work area and any live electrical parts — or the circuits shall be deenergized. In all such cases, the supervisors of the nonelectrical workers shall report the location of the work to the electrician in charge. The electrician shall instruct the supervisors of the nonelectrical workers regarding proper precautions to be taken against electrical hazards, and provide and erect proper insulating barriers as may be applicable or provide for deenergizing and locking out of circuits where possible. The supervisor of the nonelectrical workers is responsible for carrying out precautionary instructions given by the electrician in charge.

12. First Aid

a. Resuscitation. Before touching a victim of electric shock, the circuit should be deenergized or the victim freed from the live conductor by the use of some suitable nonconductive object such as a dry wooden stick or pole. Artificial resuscitation procedures appropriate to the victim's condition shall be started *immediately*. Electrical workers shall be instructed in the mouth-to-mouth, mouth-to-nose, back-pressure arm-lift, poletop (transmission line workers), and external heart massage methods of resuscitation. Training of employees not familiar with these methods shall be arranged with the safety officer or the medical department. Instruction in external heart massage shall be under the direct supervision of medical personnel.

b. Attendant. A man who is qualified in administering first aid for electric shock shall be immediately available whenever work is being performed on live circuits.

1502. SAFETY FROM FIRE

1. **Preventing Fires.** General cleanliness in the entire area is essential for the prevention of fires. In addition, the following requirements are particularly applicable in an area where work with electricity is being carried on:

a. Avoiding Use of Flammable Cleaning Fluids.

(1) Gasoline, benzene, ether, and similar flammable cleaning fluids shall never be used on either energized or deenergized electrical apparatus.

(2) Alcohol shall not be used for cleaning equipment as it damages most types of insulating varnishes.

(3) Alcohol shall never be used for cleaning near electrical equipment from which a spark might be received.

b. Keeping Machinery Clean. Oil, grease, carbon dust, etc., can become ignited by electrical arcing. Machinery is to be kept absolutely clean and free of all such deposits.

c. Avoiding Open Flames. Lighted matches or other open flames shall never be used in confined spaces because of the danger of explosions and fires.

2. **Fire Fighting.** In the event of a fire, the following procedures are to be carried out:

a. Rules Applying to All Fires:

(1) Immediately deenergize the circuit or equipment affected.

(2) Call the Fire Department. In a few cases the means of calling the Fire Department may be much closer at hand than the electric power controls. In such cases the Fire Department should be called first, but circuits should be deenergized before fire fighting begins.

(3) Control the fire insofar as possible with the correct type of firefighting equipment until firefighting personnel arrive. Firefighting equipment must be kept readily available at all times.

MT-PWHD-005496

0008 117 REDACTED J-M 83

b. Rules Applying To Specific Situations

(1) Fires near standpipes. If an electrical fire occurs at a location where standpipes are available, the standpipes should be manned only by experienced firefighting personnel who are familiar with that equipment.

(2) Cable Fires. In case of cable fires in which the inner layers of insulation, or insulation covered by armor, support combustion, the only positive method of preventing the fire from running the length of the cable is to cut the cable and separate the two ends.

c. Firefighting equipment. Extreme care shall be taken to select the proper type of equipment to combat electrical fires. The preferred extinguisher for electrical fires is the Class C extinguisher. The stream from this extinguisher is nonconductive and can be directed against energized circuits without danger of shock. Fire extinguishers ordinarily used for electrical fires are the carbon dioxide, dry chemical, and vaporizing liquid types. (See Chapter 2 for details.) The latter type is never to be used in confined spaces or in large quantities. If it is necessary to use salt water extinguishers against electrical fires, extreme care must be observed to avoid shock. The same danger exists in lesser degree if fresh water is used.

3. Inspection Before Current Is Restored. If the electrical wiring or apparatus has been affected by fire a careful inspection must be made before the current is turned on in the building.

1503. INSPECTION AND MAINTENANCE

1. Personnel Responsible. Inspection and maintenance work on electrical equipment shall be performed only by qualified and authorized personnel.

2. Inspections. Electrical appliances and equipment must be periodically inspected for adequacy and functioning of safety features and for damaged insulation and loose connections (the exact periods of time should be determined by the safety officer or other qualified person). Appliances and equipment found to be defective shall be removed from service.

3. Overhauling Machinery. Unauthorized modifications to electrical wiring and equipment shall not be made, nor shall authorized modifications be made by other than qualified personnel.

4. Cleaning. Electrical and electronic equipment must be kept clean at all times to ensure proper performance. The following precautions are to be observed when cleaning:

a. Safety In Use of Cleaning Equipment

(1) Brushes, dusters, brooms, or other such articles which may be used within four feet of or on electrical equipment having exposed or current-carrying parts shall not themselves contain any exposed metal parts.

(2) If a vacuum cleaner is necessary, use only one with a nonmetallic hose and an adequate dust receiver.

(3) Use sandpaper and files only upon competent advice. Emery paper shall never be used on electrical equipment because of the conductive residue remaining after use.

(4) Do not use solvents unless absolutely necessary. When solvents are necessary, use only the smallest possible quantity of approved solvent.

b. Blowing Out Equipment. Use only rubber or insulating hose in airlines for blowing out equipment. Use no more than 10 pounds of pressure to avoid damage to the insulation and injury to personnel. Be sure the air is free from water (see Article 0902.3). Never turn compressed air on yourself or others, since it can cause serious injury.

1887

MT-PWHD-005497

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1510. SPECIAL WARNINGS TO PERSONNEL

Care shall be taken in handling all tools, loose metal parts, liquids, etc., which it is necessary to use in an area where there is electrical equipment or electrical work being done. The following general rules shall apply:

1. Danger from Metal Objects

a. Personnel shall exercise care when it is necessary to walk above open electrical equipment or exposed wires to insure against dropping or loss of metallic objects attached to clothing.

b. Tools of magnetic material can be pulled into contact with dangerous circuits when these tools are used in the vicinity of magnets associated with magnetrons in radars. Care must be taken to avoid this hazard.

2. Danger from Foreign Objects. Storage or insertion of foreign articles in or near switch-gear, control appliances, panels, etc., is forbidden.

3. Danger from Energized Equipment. Personnel required to work on energized equipment shall be familiar with the precautions in article 1525.

1511. SECURING SWITCHES PRELIMINARY TO WORK

1. Deenergizing Circuit. In general, all main circuits shall be deenergized before any work is performed on them. When it is necessary, due to existence of emergency conditions, to work on such circuits, precautions cited in article 1501 shall be observed. When electrical equipment is to be worked on, it shall be disconnected from the source of supply by opening main or branch supply switches, circuit breakers, or cutouts so as to completely eliminate the possibility of current flowing to the equipment. Switches, circuit breakers, or cutouts opened for this purpose shall be secured (preferably locked) in the open position, shall have tags attached, and only the individual placing the tag shall remove it and reenergize the circuit.

2. Pier Box Connections. Pier box connections shall be made and broken only by qualified shore activity personnel in accordance with procedures prescribed herein.

3. Tagging. After securing, switches shall be tagged with a card bearing a warning that they are not to be closed, such as: DANGER–WORKING ON CIRCUIT–DO NOT OPERATE SWITCH EXCEPT BY DIRECTION OF (NAME). . . . . The tag is to be signed and dated by the person directly in charge of the work. The tag shall be placed in a conspicuous location and well illuminated. A separate record shall be made and retained by the person who placed the tag.

4. Testing and Discharging. After switch and circuit breakers have been opened, and before work has been started, the de-energized circuit shall be tested (see article 1525.3) and discharged to ground (see article 1512.8).

5. Removing Tag or Lock. When the work has been completed, the tag shall be removed by the same person who attached it. No one should remove another person's tag. If the switch has been locked it shall be unlocked and the circuit restored by the person retaining the key.

6. Tagging by More Than One Party. When more than one repair party is engaged in the work, a signed and dated tag for each party shall be placed on the supply switch. Each individual is to remove only his own tag when the work has been completed and it has been determined that all persons are in the clear.

1512. GROUNDING OF METAL PARTS

1. Where Necessary. Metal cases, bases, frames, and other metal parts of electrical equipment, appliances, machines, and fixtures powered from supply circuits in excess of 30 volts AC or DC, shall be grounded. Where inherent grounding is not provided by the mounting arrangements, ground connections shall be provided to ground the frame,

1383

MT-PWHD-005498

0008 1180
REDACTED
J-M 83

enclosure, or support of permanently installed electrical equipment. Semiportable equipment which is normally used at a fixed location shall also be grounded. Portable electrical equipment in conductive housings shall have adequate grounding.

2. **Grounding Conductor.** The grounding conductor shall have a cross sectional area at least equal to, and preferably greater than, the cross sectional area of the line conductors which carry power to the equipment. The grounding conductor shall make positive metal-to-metal, low resistance contact with the equipment at one end and at the other end with the metal object used as a ground, the hull of the ship in shipboard installations, and the ground rods, water pipes or installed grounding object in shore installations. The resistance between the earth and the metal object used as ground shall not exceed 3 ohms.

3. **Grounded-Type Plugs and Receptacles**

a. **Use.** Navy specifications for portable tools require that the electric cord for such tools be provided with a distinctively marked ground wire in addition to the conductors for supplying power to the tool. Double insulated portable electric tools obtained from sources qualified under the applicable military specification are exempt from this grounding requirement. The end of the ground wire within the tool shall be connected to the tool's metal housing. The other end shall be connected to a positive ground. For this ground connection, specifically designed grounded-type plugs and receptacles which automatically make this connection when the plug is inserted in the receptacle, shall be used. These grounded-type receptacles shall be installed for all power outlets. When installed, they shall be used with the grounded-type plugs to ground portable tools and equipment. If grounded-type receptacles have not yet been installed, they shall be installed as soon as possible. Portable tools not provided with the grounded-type plug, and miscellaneous portable electric equipment which does not have a cord with a ground conductor and grounded plug, shall be provided with a 3-conductor cord with a standard Navy grounded-type plug. The ground wire shall be connected to a positive ground, in accordance with article 1512.2, above.

b. **Connecting Plugs and Cords.** Care must be exercised in connecting the plugs and cords. The grounding conductor of the cord shall be connected to the ground contact of the plug at one end and to the metal equipment housing at the other end. The cord shall be arranged so as not to create a tripping hazard. If the conductor which is connected to the metallic equipment housing should be inadvertently connected to a line contact of the plug, a dangerous potential would be placed on the equipment casing, which might result in a fatal shock to the operator. If the cord is pulled loose from the plug only qualified electricians shall repair it.

4. **Other Types of Plugs and Receptacles.** If the grounded-type plugs and receptacles have not been installed in the spaces where a portable tool is to be used, other types of plugs and receptacles may be used only if a separate ground wire is connected between the tool housing and a positive ground. When the tool cord does not include an extra wire for grounding, an additional insulated wire should be connected between the metal housing of the tool and ground. If the tool housing has two or more conducting parts which are not electrically connected, each part shall be connected to the ground wire. Connection of the ground wire to the tool housing and to the ground shall be by means of screws or bolts. Employment of spring clips for either end of the grounding wire is prohibited.

5. **Other Means of Grounding.** When the ground connection is to be made by means other than a contact in the plug and receptacle, care shall be taken to secure a good contact between the ground wire and the metal by scraping away paint to provide a clean surface. The ground connection shall be made before inserting the power supply connecting plug, and the plug shall be pulled out before removing the ground connection. Frequent inspection of all the connections

1889

MT-PWHD-005499

REDACTED
J-M-83

in portable electric tools shall be made to assure that the supply cord and its connections within the tool are suitably insulated and that the ground connection is intact.

6. Grounds on Power Lines. Except in an installation where local power conditions require a grounded supply line as a normal operating condition, the power shall be removed from equipment immediately when the power line shows a ground. The circuit shall not be energized until it has been determined that the ground is not in the equipment.

7. Wooden Buildings. In wooden buildings, care should be exercised to run all electric wiring at least four feet from all down-leads of any lightning protective system. All steel masts, metallic gutters and down spouts, steel beams, columns, and other metallic members of appreciable mass should be grounded.

8. Discharging Machines to Ground. The charge retained by electrical equipment when it is secured is, in certain cases, sufficient to cause a severe shock. Before the terminals of an apparently dead piece of equipment are touched, the equipment should be discharged to the ground by momentarily connecting the terminals together and to ground. Capacitors, reactors, lightning arresters, transformers, and similar equipment with high values of capacity or inductance are particularly dangerous and should be discharged twice at intervals of not less than 15 seconds if the highest possible level of personal safety is to be attained.

1513. PORTABLE ELECTRIC EQUIPMENT

Electrically powered portable tools such as drills, grinders, scaling hammers, and sanders may become sufficiently damaged during normal use to cause electrical shock to the user. Cases are reported in which shock has been fatal. Shipboard conditions are specially conducive to increasing the severity of a shock because the person affected is usually in contact with the ship's metal structure and because the dampness often present in the user's clothing lowers electrical resistance. All personnel who use portable electric tools are cautioned to make certain that a proper ground connection is provided. (See article 1512 for grounding precautions).

1. Portable Cables. Portable electrical cables shall be carefully selected and maintained. Spliced portable cables are extremely dangerous and shall never be used unless an emergency warrants the great risk involved. Portable cables should be of sufficient length that they will not be subjected to longitudinal stresses or need to be pulled taut to make connections. Current-carrying capacity should be ample for all expected power demand. Portable cables should be checked frequently while in service to ascertain degree of heating. Any cable which feels more than comfortably warm to the bare hand placed outside the insulation should be checked immediately for overloading. Interconnections between lengths of portable cable shall be made only on approved connection blocks or by other approved fittings which shall be suitably insulated and enclosed to eliminate all possible hazards from fire or shock to personnel.

2. Portable Appliances. No electric fan may be operated without the fan blade guard in place (see 0204.7). No commercial household appliance shall be operated which has not been approved by the Underwriters' Laboratories.

1514. SWITCHES AND CIRCUIT BREAKERS

Switches and circuit breakers perform the same function, and the precautions to be taken with them overlap in many details. The following precautions shall be taken as they are applicable to the particular circuit:

1. Installation of Switches. Switches shall be installed so as to minimize danger of accidental operation. Where practicable, they shall be installed so that gravity cannot operate them. When this is not practicable, they shall be equipped with suitable latches to prevent accidental closing. Except where absolutely necessary, switches are not to be

1390

MT-PWHD-005500

0008 1182

REDACTED

J-M-83

installed in locations where explosives or flammable vapors exist. When they are installed in these locations, they should be of the special explosion-proof type. Only safety-type switches shall be permitted at machines.

2. **Operating Switches.** A workman shall not operate any system switch, circuit breaker, or other disconnecting device until he is instructed to do so by proper authority and is thoroughly familiar with the equipment involved. When operation has been authorized, the following precautions shall be taken:

a. **Preliminary Precautions**

(1) When maintenance or repairs at a naval activity involve switching operations which may affect the serving utility's system, the station electrical shop supervisor must notify the system operator of the utility, so that prearranged emergency measures may be followed if the utility's circuit breakers trip out. The electrical shop supervisor shall prescribe and enforce detailed switching and tagging procedures.

(2) When local branch circuits which feed moving or rotating parts are to be energized, men near moving parts must be notified that the circuit is to be energized. This is particularly important in cases where rotating antennas are energized. Where the men are not visible from the control station, a safety watch shall be maintained with adequate means of communication between the station and the watch.

b. **Safety During Work**

(1) During the time the electrical foreman is switching, the men on the job shall not follow him or congregate where the switching is being performed. Every man engaged in the work shall be instructed concerning the job procedure and precautions to be observed.

(2) Switch handles should always be moved to definite positions.

(3) Before doing any switching on a regulated feeder, workmen should be sure that regulators are off the automatic position and set in the neutral position.

c. **Safety With Special Type of Switches**

(1) Outdoor Disconnecting Switches. Outdoor disconnecting switches shall not be operated without the disconnect-pole provided for that purpose.

(2) Air-Break Switches. Each time an air-break switch is opened, a check shall be made to make certain that all contacts are actually open and safe clearance is obtained on all three phases. The position of the operating handle is not to be depended upon as evidence that the switch is open.

3. **Safety with Circuit Breakers**

a. **Precautions Preliminary to Work.** Before any work is done on a circuit breaker the following precautions shall be taken:

(1) All control circuits to which it is connected shall be deenergized.

(2) Draw-out circuit breakers shall be switched to the open position and removed before any work is done on them.

(3) Disconnecting switches ahead of circuit breakers shall not be opened until after circuit breaker is tripped to open position. No work shall be done on the opened circuit breaker until all isolating switches protecting it also have been opened.

(4) Where disconnecting switches are not provided to isolate circuit breakers, the supply bus to the circuit breaker shall be deenergized on all circuits breaker shall be age is in excess of 150 volts. On circuits where the voltage is below 150 volts, work may be done under emergency conditions with the circuit breaker energized by strict adherence to the provisions of regulations for working on energized circuits contained in article 1525 herein.

(5) Before working on an oil circuit breaker, workmen must be sure that the breaker cannot be opened or closed automatically. When possible, it should be in the open position or have the operating mechanism blocked.

b. **Operating Circuit Breakers.** When operating circuit breakers, follow these precautions:

1891

MT-PWHD-005501

REDACTED 1183
J-M 83

(1) Use only one hand.

(2) Keep the hands clear of parts other than operating handles.

(3) Touch only one breaker handle at a time.

(4) Close isolating or back-up switches before closing circuit breaker to restore service or to energize circuits.

(5) Trip circuit breakers before opening switches.

(6) Keep the face turned away while closing circuit breakers.

(7) A circuit breaker shall not be prevented from performing its normal function by short circuiting or blocking out interlocking, overload, or other protective devices, except for purposes of authorized test work.

(8) Never stand over a circuit breaker while the power is on.

c. **Closing Circuit Breakers.** Before a branch or equipment circuit breaker or switch is closed, it should be determined that:

(1) The circuit is ready, equipment connected to it is in condition to be energized, and all clearance has been given up and all tags removed;

(2) Men working on the circuit have been notified that the circuit is to be energized and they are in the clear;

(3) Circuit protective devices are in good working condition.

4. **Labeling.** Switches and circuit breakers shall be labeled to show the equipment serviced. Care shall be taken to insure that these labels are kept up to date and not obliterated.

1515. WORKING ON TRANSFORMERS

Precautions of this section are limited to the equipment used in the ordinary electric circuit. For further details concerning capacitors, personnel are referred to the precautions in 1542.

1. **Protection of Personnel at Work**

a. **Removing Fuses.** When removing transformer fuses, the workman must wear rubber gloves with leather over-gloves. This applies also to fuses which are being replaced by means of switch sticks equipped with fuse tongs or by means of regular fuse tongs, where the circuit voltage exceeds 150 volts.

b. **Standing On Live Transformers.** Workmen must not stand on top of energized transformers, regardless of voltages, except in extreme emergencies, and then only with the full knowledge and consent of the man in charge of the work crew. When such procedure is followed, the transformer cover shall be first covered with a rubber blanket, protected in turn with a rubber bag. Standing on top of a transformer when wearing climbers is strictly prohibited under any circumstances.

c. **Raising And Lowering Transformers.** Workmen must not stand beneath transformers which are being raised to, or lowered from any overhead structure. While transformers are being raised or supported with blocks, men on the pole or structure must take a position above, or well in the clear of the transformer.

d. **Protection Against Gaseous Fumes.** Large transformer case interiors are not normally ventilated and very frequently contain poisonous or explosive fumes. No work should be done inside any transformer case until provisions have been made to continually exhaust such fumes while the work is progressing. Men working in transformers should be instructed to report immediately any feeling of ill effects from fumes or gases, and shall be ordered out of the immediate area until they have recovered.

2. **Care of the Transformer**

a. **Grounding Transformers.** All transformer cases shall be grounded to a positive ground. On systems operating with one conductor grounded, the case shall also be connected to the ground conductor at the transformer.

b. **Taking Paralleled Transformer Out of Service.** When a paralleled transformer is taken out of service the secondary phase lead or leads must be disconnected before the primary circuits are opened. The secondary neutral or ground connection should not be disconnected until the primary cutouts have been opened.

1892

MT-PWHD-005502

REDACTED
J-M 83

1516. ELECTRICAL SUBSTATION FENCING

All electrical equipment, such as substations in permanent outside locations, having any exposed carrying parts less than eight feet above ground shall be completely enclosed by a metallic fence and made accessible to authorized personnel only. Such fences shall be high enough to discourage climbing and shall have interior clearance, electrical grounding, warning signs, and grounds maintenance as prescribed in NAVDOCKS DM-4, *Electrical Engineering*.

1517. CABLE

1. Electrical power cable is not to be used to support chain falls, lifting tackle, or weights of any kind.

2. Scaling, chipping, and wire brushing shall not be performed on power or lighting cable.

3. Before welding or drilling bulkheads or decks, a thorough inspection shall be made of the opposite bulkhead. Cable that might be affected shall be removed from the immediate area by competent personnel.

4. Power cable is not to be used as ladder rungs for climbing.

5. Cable identification tags must not be removed or painted.

6. Work on power, lighting, or telephone circuits shall not be performed by other than authorized and qualified personnel. This requirement applies also to packing glands (terminal or bulkhead tubes) used in connection with these circuits.

7. All electrical conductors shall be considered to be carrying current until it has been established beyond doubt that they are dead.

1518. FUSES

1. Fuses are to be removed and replaced only after the circuit has been completely deenergized.

2. Whenever practicable, a circuit should be checked before replacing a burned out fuse, as the trouble is usually indicative of a circuit fault.

3. Fuse pullers made of insulating material shall be used for removing and replacing most fuses. (This includes all except those mounted in plug-type fuse holders, which are easily removed by unscrewing the plugs.)

4. A blown fuse shall be replaced by a fuse of the same ampere capacity. Insertion of metal discs, coins, etc. in back of plug fuses, or the shorting out of cartridge type fuses, is strictly prohibited.

5. Where removable fuse links are used, only one link of correct rating is to be used for each fuse.

6. Special precautions shall be taken to insure that the secondary of a current transformer is not opened or disconnected until it has been positively determined that the primary circuit has been deenergized. This precaution shall be observed regardless of the operating voltage of the circuit in which the current transformer primary is placed.

1519. SERIES-WOUND MOTOR

A series-wound motor on a direct-current machine should not be started unless the motor is attached to a substantial load. Otherwise the motor may attain dangerous overspeeds.

1520. WET AND DRY CELL BATTERIES

1. Wet Cell Batteries

a. General Precautions. The following safety precautions are to be observed in connection with wet cell storage batteries:

(1) Keep flames and sparks away from the vicinity of batteries.

(2) When using tools around batteries exercise care not to short circuit battery terminals. Use only tools with insulated handles for removing and replacing batteries.

(3) Never open batteries except in well-ventilated spaces and only in extreme emergencies if the room temperature is above 125 degrees F.

(4) Keep the temperature of the battery compartment below 95°F., if possible.

(5) Be sure to ventilate a battery compartment which has been sealed before turning on the lights, making or breaking electrical connections, or performing any

MT-PWHD-005503

REDACTED
J-M 83

type of work in the compartments. "Closed cell" batteries do not require ventilation precautions. (See NAVDOCKS MO-203, Vol. 1, *Wire Communication and Signal Systems Maintenance*.)

(6) Avoid sparks when removing or replacing batteries in compartments which may contain fumes.

(7) When using batteries with one terminal grounded, disconnect the grounded terminal before removing the battery and do not reconnect it until the battery has been replaced.

(8) Whenever practicable, maintenance and service facilities for lead-acid batteries should be separated from those for nickel-iron-alkaline batteries.

b. Charging

(1) Deenergize Circuit. The charging current shall be deenergized before making any repairs to terminal connections or before batteries are connected to or disconnected from the charging line.

(2) Sparks and Flames. Extreme care shall be exercised to avoid striking sparks and open flames in the vicinity of batteries while being charged. Even when optimum ventilation is provided, the hydrogen concentration immediately above the cells is within the explosive limits when charging at a fully gassing rate.

(3) Ventilation. Charging shall not be started until it has been ascertained that the battery compartment or charging room is adequately ventilated. Charging shall be stopped whenever ventilation is interrupted and shall not be resumed until adequate ventilation has been restored. Battery charging facilities are considered to be adequately ventilated when the hydrogen concentration at distances greater than 6 inches above the cells is maintained below 3 percent. Charging facilities located in large open spaces, having adequate industrial ventilation may not require supplementary ventilation, or a localized air flow directed over the cells may suffice. Unless adequacy has been definitely determined, particularly for facilities located in confined spaces, a survey of the hydrogen concentration should be made with the equipment operating under freely gassing conditions. A portable hydrogen combustible gas indicator is available in standard stock (FSC 6665) for this purpose. In charging lead-acid batteries at a freely gassing rate, the flow of exhaust air in cubic feet per minute, Q, required to maintain hydrogen below the maximum safe level (3%) in a closed compartment containing N number of cells at a charging rate of I amperes may be computed from the formula:

$$Q = 0.018\ IN.$$

This formula includes an air distribution factor of 2 which allows for nonuniform distribution of air flow over the cells and for extraneous currents not contributing to the required hydrogen dilution.

c. Handling Electrolytes

(1) Protective Clothing. When engaged in electrolyte handling, mixing, or filling operations, personnel shall wear face shields and chemically resistant gloves, footwear, and aprons.

(2) Mixing. Water shall never be poured directly into battery acid. The acid must always be poured slowly into the water.

(3) Handling Equipment. Large containers of electrolytes such as acid carboys shall not be handled manually but should be moved by appropriate materials handling equipment. Permanent mixing and filling facilities so designed as to minimize the hazards of manual handling and spillage should be provided.

(4) Showers and Eye Fountains. Deluge showers and eye-wash fountains shall be provided in the immediate vicinity of all battery maintenance and electrolyte handling operations.

2. Dry Cell Batteries.

a. Type 19026 Dry Batteries

(1) Shock Hazards. The 300-volt B Section of the Navy Type 19026 pack battery is capable of giving a very serious, and even fatal, shock upon contact. Extreme care must be taken not to come into contact with the terminals of this battery or of any high voltage battery.

(2) Disconnecting the Battery. When this type battery is to be disconnected

1394

MT-PWHD-005504

REDACTED
J-M 83

from the operating apparatus, the current flow shall be stopped before disconnecting the plug. It is possible for sufficient hydrogen gas to accumulate in this battery to produce a serious explosion if ignited, and a spark produced by pulling the plug from the socket while the current is flowing is liable to ignite accumulated gas.

b. Hydrogen Generation. Use of a multicell dry battery shall be discontinued after its closed circuit voltage has dropped below 0.9 volts per cell. Discharging a battery beyond this point may introduce an explosion hazard caused by the generation of hydrogen gas.

c. Mercury Battery Explosions. Under excessive heat, mercury batteries are likely to explode. Sufficient heat to cause an explosion may be generated by accidental shorting or by incineration. Care should be exercised in using mercury batteries to prevent accidental shorting and they should be disposed of by means other than incineration, preferably by burial in nonconductive containers.

ELECTRICAL CIRCUITS

1525. WORKING ON ENERGIZED CIRCUITS

1. When Permissible. Repairs are not to be made on energized circuits except in an emergency. The commanding officer or his authorized representative shall determine whether an emergency exists. A circuit must be considered energized until it has been checked and the switch opened and tagged. (See article 1511 and paragraph 3 below.) A qualified supervisor shall be in charge of testing for voltage and installing grounds.

2. Personnel Involved

a. Requirements for Workers. Repair work on an energized circuit shall be performed only by personnel fully aware of the dangers involved, including those dangers encountered on the so-called lower potential circuits (below 600 volts) as well as those on higher voltages (above 600 volts.)

b. Supervisors. All work shall be supervised by qualified technicians or experienced communications or electronics material officers.

c. Standbys. Men should be stationed by circuit breakers or switches. Telephones should be manned so that circuits can be immediately deenergized in case of emergency. A man qualified to administer artificial resuscitation for electric shock (see article 1501. 12) shall stand by during the entire period the work is being performed.

d. Insulating Workers From Ground. Persons performing the work shall be insulated from ground and shall avoid possibility of contact with grounded hand rails and exposed metal deck or equipment frames.

3. Checking the Circuit. When a circuit below 600 volts is to be checked, the voltmeter or voltage tester should first be tested on a circuit known to be operating in order to determine if the testing device is in good condition. When voltages of 600 volts or more are to be measured, the following precautions are to be observed:

a. Preparing the Equipment

(1) Deenergize the equipment to be tested.

(2) High voltage capacitors and the terminals to which the test equipment is to be connected shall be discharged at least twice, with a minimum fifteen-second interval, by the use of a suitably insulated shorting or grounding bar.

(3) Attach a temporary but secure ground to the circuit.

(4) Ascertain that the test equipment controls are set correctly for testing of the high voltages.

(5) Connect to the desired test points, the test leads capable of safely carrying the high voltages.

MT-PWHD-005505

REDACTED
J-M 83

0008 1187

(6) Remove the temporary ground from the circuit.

(7) Withdraw from the equipment under test, making sure that you are free from the leads and in a proper position for taking meter readings correctly.

b. Taking the Measurements

(1) Do not take the measurements directly, as by means of flexible leads or probes.

(2) Assign the responsibility of energizing the equipment to an assistant standing by the switch.

(3) Do not touch the test instruments while the power is on.

(4) After taking the reading, deenergize the equipment.

(5) Before removing the test leads, discharge high voltage capacitors and the terminals to which the test equipment is connected at least twice, with a minimum fifteen-second interval, by the use of a suitably insulated shorting or grounding bar.

(6) Attach temporary ground to the terminals to which the test instrument is connected.

(7) Remove the test leads.

(8) Remove the temporary ground.

(9) Repeat the above precautions for each measurement as applicable.

4. Precautions for Specific Voltages. Although many of the precautions listed for work with specific voltages relate to line work, the over-all safety measures relate to *all work on live circuits* and for that reason are included here with other general working rules.

a. Low Voltage Work, 0 To 600. Live conductors and equipment operating at 600 volts or less may be worked upon if the following requirements are met:

(1) Adjacent live or grounded conductors and equipment shall be covered with insulating material or approved rubber protective equipment.

(2) Two men should work together, particularly when work is done on energized parts carrying more than 150 volts, in wet weather, or at night. When working on energized lines a man should not change his position on a pole without first informing others working nearby.

(3) Bare or exposed places on one conductor must be taped or covered before another conductor is exposed.

b. Intermediate Voltage Work, 600 To 5,000 Volts

(1) Testing Voltage Meters. All conductors and equipment must be considered as carrying current and as being alive until it has been determined beyond doubt that they are dead. When positive proof as to whether a conductor or a piece of equipment is energized cannot be established by a visual check, an approved voltage detector is to be used. Before being used, the detector must be checked on a conductor that is known to be alive and a positive indication noted. This check on a known live conductor must be repeated after the test on a dead conductor has been made. When it is not possible to recheck the voltage detector on a live conductor, two voltage detectors should be used, one as a check against the other.

(2) Insulating Equipment. When work is to be done on or within reach of conductors or equipment operating between 600 and 5,000 volts, energized and grounded conductors or equipment within reach must be isolated with suitable barriers or covered with rubber hose line, insulator hoods, line protectors (pigs), or blankets. If it becomes necessary for the workman to change his working position he must cover or barricade any energized or grounded conductors or equipment that will be within reach in the new position.

(3) Deenergizing. When conditions permit, the section of the line being worked on shall be deenergized by opening the sectionalizing switches, and grounded.

c. High Voltage Work, 5,000 Volts and Over. Lines and equipment operating at 5,000 volts or over must be deenergized and grounded (see article 1512) before work is started, except in emergency repairs on overhead lines, which may be worked on alive with approved live-line tools.

1396

MT-PWHD-005506

REDACTED
J-M 83

0008 1188

(1) Precautions when circuits deenergized. Work on deenergized circuits must be done between two sets of grounds, one set to be placed on the first pole or structure toward the source of energy and the other on the first pole toward the load. When grounds are to be attached, the ground connection must be made first. When grounds are to be removed the ground connection must be broken last.

(2) Using live-line tools. The following precautions must be taken when live-line tools are used:

(a) Work with live-line tools shall not be performed when rain or snow is imminent or falling, or when heavy fog, dew, or any form of excessive moisture is present.

(b) When working on lines energized at more than 5,000 volts, use approved hot-line tools without rubber gloves. Handle series street lighting circuits supported on arms with other lines energized at more than 5,000 volts, the same as the power supply conductors.

(c) No more than one conductor may be worked on at a time with live-line tools.

(d) Live-line tools must be kept dry and free from dirt. Tools which have been subjected to damp weather must be thoroughly dried and tested before being used again.

(e) Live-line tools being transported on line trucks shall be stored so as to prevent damage to them. Waterproof canvas bags may be used for this purpose. A compartment equipped with padded hooks or binds may be built into the truck for this purpose. See NAVDOCKS MO-200, *Electric Power Distribution Systems Maintenance.*

(3) Body clearance for high voltage work. A minimum body clearance from energized lines and equipment shall be maintained by men working on or around electrical equipment of high voltage, as shown in the following table:

Operating Voltage (Kilovolts)	*Minimum Distance (Feet)*
5 to 7.5	1
7.5 to 12	2
12 to 33	3
33 to 66	4
66 to 132	5
132 to 220	8

d. Live Line Barehand Work. The live line barehand technique utilizing the insulated aerial servicing platform is prohibited unless specific approval has been granted by the Naval Facilities Engineering Command in accordance with BUDOCKS Instruction 5100.10 of 7 January 1965.

LINE CONSTRUCTION AND DISTRIBUTION

1530. SCOPE

This section deals only with equipment and working precautions specifically applicable to line construction and distribution work. *Of primary importance to the safety of all workmen in the area is the employment of maximum precaution in working on circuits and equipment operating above 600 volts.*

1531. EQUIPMENT USED IN LINE WORK

1. **Transmitting Tools and Equipment.** Tools and other materials shall not be thrown or dropped down to personnel working on another level. They are to be raised or lowered by means of handlines or canvas toolbags or buckets. Workmen should stand clear when tools and other materials are being raised or lowered. They should not walk or stand under a load which is not properly placed and secured.

2. **Safety in Using Tools**

a. Using Portable Electric Tools. The cases of all portable electric tools, regardless of their voltage, which are held in the hands while being operated shall be grounded. (See article 1512). Care must be taken that the ground wire is not disconnected or broken.

b. Skinning Knives. Skinning knives shall not have sharp points. Knives with metal shanks extending through the handles shall not be used.

c. Pliers. Metal tool handles shall be covered in accordance with the methods described in article 1501.5.

MT-PWHD-005507

REDACTED
J-M 83

d. Flashlights. Flashlights designed for holding in the hand shall not be used which have any exposed metal parts. Use of friction tape or other tape to cover exposed metallic parts in order to circumvent the intent of this regulation is strictly prohibited.

3. Proper Use of Protective Devices

a. Rope. (See NAVDOCKS MO-200).

(1) Rope which is used on or near energized equipment is to be free of metal strands.

(2) Rope shall be replaced when the strands become frayed.

(3) Tape, string, or marlin cord shall not be used to repair rope.

(4) Rope is to be kept free of foreign material such as bits of solder which could cut the hands or rubber gloves.

(5) If it is necessary to take hold of a rope passing through a snatch block or around a niggerhead, the hands shall be kept at a safe distance from block or niggerhead.

(6) Uncoiled rope or wire shall never be left unguarded where it creates a tripping hazard.

(7) Safety lines, handlines, and other ropes or wire are not to be hung from a pole in such a manner that they can in any way interfere with traffic.

b. Climbers. (See NAVDOCKS MO-200)

(1) Climbers are *not* to be worn when workers are working on the ground or on a ladder, standing on a rubber blanket, moving from job to job, or riding in a vehicle.

(2) Climbers shall not be used after the gaffs are worn to less than 1¼ inches measured on the underside.

(3) Gaffs should never be sharpened on the underside, except to make the shoulder. Such sharpening changes the angle to which the gaffs are set. When this angle is changed, the climber is unsafe for use. Because of the danger of removing the temper from gaffs, care should be taken to keep the gaffs cool during sharpening operations.

(4) Climbers equipped with extra-long spurs shall be used to climb poles which have not been barked or skinned.

c. Body Belts and Safety Straps. (See NAVDOCKS MO-200)

(1) Construction

(a) Body belts or safety straps which have been stitched across the width shall not be used.

(b) Tape shall not be used to mend, protect, or mark belts or straps.

(c) A leather thong with a wooden or fiber bar shall be used for holding tape which is to be used by the workman. The use of chains for holding tape is forbidden.

(d) A leather pouch must be used on the body belt for holding pliers. Wire keepers are prohibited.

(e) Snaps on safety straps must be of drop forged steel.

(2) Inspection and Repair. Body belts and safety straps are to be examined by the foreman during regular tool inspections. If there is any doubt as to the safety of a belt or strap it should be repaired or replaced at once.

(3) When Worn. A workman is to wear his safety strap when he is working on a pole, ladder, or structure.

(4) Placing the Safety Strap

(a) The safety strap is to be placed around a part of the structure which is of sufficient strength to sustain a man's weight and his equipment and shall be so placed that there is no danger of its slipping. (That is, it must be at least eighteen inches from the end of the part on which it is fastened.)

(b) Where possible, the strap should be placed under an arm or brace.

(c) It must not be placed around any part of a structure which is being removed.

(d) The strap shall rest flat against the surface without twists or turns.

(5) Securing the Strap

(a) While a workman is in a working position a snap must be placed in *each* D-ring. (When a strap is being worn but not in use both ends of the strap shall be snapped into the same D-ring.)

MT-PWHD-005508

0008 1190
REDACTED
J-M 83

(b) When a workman is attaching the safety strap to the D-ring, he should not rely on the "click" of the snap-tongue as an indication the fastening is secure. Before placing his weight on the strap, he should determine that the snap and the D-ring are properly engaged. The tongue of the snap should be away from the worker's body when engaged in the D-ring.

(c) To prevent the snap from becoming disengaged from the D-ring, a workman should avoid pressure on the snap-tongue when leaning against equipment such as arms, pins, braces, wires, etc., which might cause the snap to open.

(6) Avoiding damage to strap. While climbing, a workman should exercise care to avoid his safety strap catching on pole steps. When climbing past a fellow employee whose safety strap is in place around the pole, he should be particularly careful not to damage that strap.

(7) Storage of belts and straps. Belts and straps are not to be stored where they are subject to damage from excessive heat or dampness.

d. **Insulators.** Insulators should be lifted by the tops to avoid cutting rubber gloves or hands on sharp edges of the petticoat. They should not be screwed down too tightly, as the tops may break off, creating sharp edges.

4. **Handling Hot Solder and Compounds.** The following precautions are to be observed in the handling of hot solder and compounds:

a. Keep furnaces far enough from manhole openings that there will be no possibility of hot metal or compound spilling into the manhole.

b. Never place a cold or wet ladle or other object in molten solder or hot compound.

c. When raising or lowering solder or compound, secure the pot with a hook and steady the line so that the pot will not swing excessively.

d. Stand clear when solder and compound are being raised or lowered.

e. Work from above or to one side while soldering.

f. Wear goggles when soldering large joints and tinning lugs and T connections.

1532. HANDLING WIRE

1. **Handling Pay-Out Reels and Jumpers.**

a. Wire must be removed from the underside of reels.

b. When the pay-out reel in a truck is being used to string wires near energized wires, the truck must be grounded.

c. When stringing wire near other wires, the man tending the pay-out reel must wear rubber gloves and should not allow any part of his body to come in contact with the wire being strung. When possible he should stand on dry lumber or other insulating material.

d. When a brake is to be used on a pay-out reel to prevent slack in the wire being strung, the brake should be applied to the rim of the reel and on the side opposite the direction in which the wire is being pulled. A crossarm or side arm may be used as a brake.

e. When work is done on jumpers, especially those that are long, the loose ends are to be held in the clear. If necessary, there must be a man at each end to hold them.

f. The ends of the tie wires must be kept coiled while they are being installed or removed in order to prevent the possibility of their accidentally coming in contact with an energized conductor.

2. **Making Connections.**

a. When possible, connections should be made when wires and other equipment are dead. Only the final connection should be made to the live conductor.

b. The ground connection must never be opened at the ground-pipe or at the ground bus-bar unless it has been disconnected first at the point of contact with the equipment it it is intended to ground. This will prevent the possibility of an accident if the ground wire or ground bus-bar should be alive.

c. When a ground wire on a pole is to be connected, the ground-pipe connection must be made first.

1899

MT-PWHD-005509

REDACTED
J-M 83

3. Removing Wires

a. Before a primary or secondary wire is removed, a workman must test it to determine whether it is dead. The man in charge shall recheck the wire to be sure it is dead.

b. A span of wire that is to be removed must be treated as alive, must have a rope attached to each end, and must be lowered only one span at a time.

c. When the take-up reel is used to coil wires being removed from line arms, the wires must be treated as alive. Wires being removed in this manner are to have a rope attached to the end farthest away from the take-up reel. The man tending the reel must wear rubber gloves.

1533. WORKING ON POLES, SCAFFOLDS, STAGING, AND TREES

1. Weather Requirements. Routine maintenance and construction work for which there is no emergency requirement should not be undertaken during severely stormy weather. Work on electrical distribution poles and towers should not be done during any wet weather conditions except for purposes of restoration of service in an emergency, in which case extreme care shall be taken to avoid possibility of electric shock due to wet or damp clothing or tools. On routine work, suspension of activity should be planned in accordance with prevailing and changing weather conditions so that power and communication lines may be safely left for continued operation until storms have abated and conditions are safe for this type of work.

2. Meeting Obstructions in Digging. When obstructions are encountered in digging operations the workman shall immediately notify the man in charge, who will arrange for the necessary precautions against such hazards as contacting live cables.

3. Securing Elevated Working Positions. When working in elevated positions, workmen must be sure their positions are secure. Every precaution must be taken to protect personnel below. Unless absolutely necessary, work is not to be performed directly beneath workers aloft.

4. Safety in Climbing

a. A workman shall never carry tools or materials in his hands while climbing.

b. Pins, braces, or guy wires shall not be used as handholds.

c. When more than one man is to ascend or descend, the first man must reach either his new working position or the ground before the second man starts to ascend or descend.

d. A workman shall never loop a rope over his hand or arm while climbing, since it may cause him to fall. He should loop one end of the rope over his pliers or connectors.

5. Special Precautions for Working on Poles. The following precautions are to be observed in connection with work on poles:

a. Poles that appear unsafe for a man to climb must be properly braced or guyed.

b. Special care must be observed in checking pine poles, as they deteriorate quite rapidly.

c. If a pole is unsound, it must be supported with pikepoles or guy lines before wires are removed or excavation started.

d. Wires and supporting guys must not be removed from a pole until the condition of the pole butt has been determined.

e. While a man is climbing or working on a pole, he is to watch for and report such dangerous conditions as defective guys, braces, or arms, rusted hardware, and other hazards.

f. The insulating value of a wood pole is not to be depended upon.

g. When it is necessary to move a pole from one point to another, nearby workers who might be struck by the pole are to be warned. A man with a red flag is to warn or stop traffic.

6. Special Precautions in Working on Trees.

The following precautions are to be observed in connection with working on trees:

a. Preparing the Tree

(1) Do all possible trimming of the tree from the ground or from a ladder.

MT-PWHD-005510

REDACTED J-M 83 0008 1192

(2) If at all possible, remove with a pruner all branches which touch wires energized at more than 300 volts

b. Climbing the Tree

(1) Ascertain whether it is safe to climb a tree by inspecting the trunk at a point near the ground.

(2) Wear rubber-soled shoes or rubbers, if possible, when climbing trees.

(3) Do not wear climbers, except when trees are to be removed; then wear them only under the supervision of the man in charge.

(4) Be particularly careful while climbing trees in wet weather, and use extreme care during winter months, as branches are usually brittle when cold.

(5) Observe special care when climbing softwood trees or trees growing close to buildings. In such cases the roots may be rotted or may have grown in one direction.

(6) Keep feet as close to the main stem as possible when stepping on branches.

(7) Remove dead limbs and stubs while climbing in order to minimize hazards when descending.

(8) Do not rely on decayed limbs or small branches for support.

c. Cutting the Limbs

(1) Saws shall be used for cutting trees. Never use hand axes, chopping axes, chisels, or draw-knives.

(2) Tie the butt end of a large limb in place with a sling or a bull rope before the cut is started.

(3) Never sit on, or attach safety belt to, a limb which is being removed.

(4) Never cut limbs directly overhead unless absolutely necessary.

(5) If it is necessary to work from a position toward the end of a limb, first secure the limb with a bull rope or sling attached to the main stem of the tree trunk. Tie the supporting rope to the trunk at a point well above the limb to be supported, or to a sufficiently strong limb above. As an additional protection, secure a line over a crotch of the main stem of the tree trunk and attach the other end to your safety belt.

1534. WORKING WITH POTHEADS

1. Purpose of Potheads. A pothead is a form of terminator usually used in power and telephone distribution. It may have terminals accessible for testing, or it may have a junction block to facilitate the connecting of cable and wire. It is designed to be hermetically sealed to the cable to exclude moisture.

2. Safety During Work

a. Opening And Closing Circuits. When opening and closing circuits by means of potheads, open the neutral pothead last and close it first.

b. Use of Insulation. Do not stand on a concrete floor or on the ground while working with potheads in manholes or vaults. Use an insulated stool, a crossarm, or other dry lumber. Carefully cover grounded framework. Be particularly careful in locations where water is present.

c. Avoiding Grounded Equipment. Stay clear of grounded equipment when working on or near potheads.

1535. WORKING ON UNDERGROUND SYSTEMS

Manholes, vaults, and tunnels may contain toxic or explosive atmospheres. The pertinent precautions prescribed in Chapter 20 shall be applied before entering such spaces.

ELECTRONIC SAFETY

1540. SCOPE

Although certain areas of electrical and electronic safety are generally similar and safety factors of one usually apply to the other, the present-day use of electronics in radar, sonar, communications, television,

MT-PWHD-005511

0008 1193

REDACTED

J-M 83

guidance control and other electronic systems makes it necessary that the safety requirements for electronics be expanded and treated as a separate field in itself.

On board ship, particularly, personnel should be made aware of the need for special precautions relating to electronic devices. Therefore personnel shall have a thorough knowledge of the following safety rules in addition to those in the previous articles.

1541. R–F WARNING SIGNS

R–F hazards signs shall be displayed in areas where the power of radio frequency radiation is sufficient to introduce a hazard to equipment or operating personnel (see article 1543). Requirements for other electrical and electronics hazard signs are contained in article 1501.10.

1542. ELECTRONICS – GENERAL

1. **Precautions With Radio Frequency Circuits.** Detailed safety in the operation of electrical circuits is prescribed in article 1525. Due to the general use of radio throughout the Navy, however, the following precautions for radio frequency circuits are emphasized:

a. **High-Voltage Circuits.** Energized high voltage circuits should not be broken except when absolutely necessary and then only when authorized by a qualified officer or other responsible official.

b. **Adjacent Equipment.** When other transmitting equipment is in use at the same installation or close by, workers should take precautions to prevent shock, burns, or other injury to themselves due to energy picked up from adjacent antennas or equipment. Circuits should be grounded to protect against such shock or burns. If the location of the protecting ground is not in the immediate area of the working party, suitable warning tags shall be employed to prevent unauthorized removal of the protective ground.

c. **R–F Insulation.** Contact with the insulation on wires carrying R–F current shall be avoided. This insulation can act as the dielectric of a condenser when contacted, thus causing shock or burn injury to personnel.

2. **Preventing Shock from Capacitors and Pulse Forming Networks.** Extreme caution shall be taken prior to working on or near deenergized circuits which employ large capacitors or pulse forming networks. A suitable grounding or shorting bar shall be used to short circuit all terminals and contacts to ground. This precaution shall be taken regardless of the length of time the equipment has been deenergized. Some pulse forming networks are capable of retaining their charge several hours after the equipment is secured and all power disconnected.

3. **Hazards of Ungrounded Units.** The chassis and frames of all power supplies and high voltage units removed for servicing shall be grounded and all circuits which are normally grounded in operation shall be grounded prior to applying power to the unit. Personnel must remember that the removal of a unit or part from the normal location within an assembly and the energizing of the unit or part, while it is outside of the normal enclosure, removes the protection given by built-in protective features such as interlocks, grounds, and enclosures. Since these safety features then no longer exist, special precautions and safety measures must be taken.

4. **Interlocks and Safety Devices.** Safety devices on electronic equipment such as interlocks, overload relays, and fuses, shall not be altered, disconnected, or modified without specific authority.

5. **Servicing and Adjusting.** No person shall reach within or enter energized electronic equipment enclosures for the purpose of servicing or adjusting, except when prescribed by official applicable instruction books, and then only with the immediate presence and assistance of another person capable of rendering aid in an emergency. Caution shall be exercised when reaching into the enclosure of equipment having high voltage points. The metal shields or shells of some capacitors, klystrons, cathode ray tubes, and other components are at high potential above ground. Maintenance personnel shall be cautioned prior to servicing equipment which contains such components.

1902

MT-PWHD-005512

REDACTED
J-M 83

6. Precautions During Overhaul and Repair.

Although local safety officials of a shipyard or repair facility will normally notify the commanding officer when electronic safety measures are required, ship's transmitting equipment shall be secured when:

a. Overhead cranes are operating in the close proximity of the transmitting antennas.

b. Personnel are removing rigging or structures aloft.

c. Transporting, loading or unloading aircraft, ammunition, volatile liquids or explosive gases on the adjacent dock or on other ships' barges in the near vicinity.

7. Energizing When Ship is in Drydock. The electronic equipment of a ship may be energized only with the express permission of the docking officer. The hull must be adequately grounded. Excitation is not to be applied to sonar transducers unless properly immersed. Sonar hoist mechanisms are to be operated only after it has been definitely ascertained that adequate clearance exists for the moving elements within their full limit of travel and that no mechanical damage will be incurred by such operation. This determination is to be made as soon as practicable after the dock is emptied. If sufficient clearance does not exist, positive steps shall be taken to prevent lowering of the transducer by gravity, manual, or power operation.

1543. RADIO-FREQUENCY EVALUATION HAZARDS

Radiation of electromagnetic waves in the radio-frequency (rf) range can create hazards in various ways depending on the frequency and power of the incident wave and on the nature and configuration of the receiving object. Of particular concern is the possibility of injurious heating of the human body upon exposure to microwave radiation and the induction of voltages in metallic structures and objects which, under optimum conditions, can result in the propagation of rf arcs and the initiation of electroexplosive devices. These hazards may be classified into three categories: hazards to personnel, hazards to flammable vapors, and hazards to ordnance. The technology involved in the assessment of the hazards in any particular radio frequency radiation problem being beyond the scope of this manual, general safety personnel are advised to consult with cognizant electronic engineers. The necessary general and theoretical analyses and detailed restrictions are given in NAVWEPS 16-1-529, *Radio Frequency Hazards Manual* and NAVSHIPS 0900-005-8000, *Technical Manual for Radio-Frequency Radiation Hazards*. The following discussion of the principal hazards involved are presented in general terms to provide safety personnel with sufficient information for the recognition of possible hazardous conditions

1. Hazards to Personnel. Radio frequency electromagnetic radiation can be hazardous to personnel in two ways. One way is by direct exposure to high density radiation where the body may be damaged by heat. A second way is by exposure to electric shock caused by rf potentials induced in metal objects that may be contacted by personnel.

a. Hazards of High Density RF Fields. Existing radar systems radiate energy in the radio-frequency band between the VHF (short wave) radio and infra-red regions and exhibit characteristics of each, such as the effects of heating and penetrating a biological system such as the human body. The presently known injurious effects of overexposure to microwave radiation are dependent on frequency and average power, and are evidenced by an increase in overall body temperature or as a temperature rise in sensitive organs of the body such as the eyes. When conditions of possible injurious exposure exist, the following precautions apply:

(1) Visual inspection of feed horns, open ends of wave guides, and any opening emitting rf electromagnetic energy shall not be made unless the equipment is definitely secured for such an inspection.

(2) Dummy loads shall be used where practical during tuning, testing or repairing rf transmitting equipment.

MT-PWHD-005513

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 1543

Subj: Radio Frequency Radiation From Radar Transmitters and Antenna Systems on Ships

Ref: (a) NAVMAT P-5100, Articles 1540-1545

1. POLICY. All personnel who may be exposed to radio frequency radiation while working in or near high density radio frequency fields and moving (rotating) antenna will observe precautions outlined herein in order to safequard against the hazards involved.

2. GENERAL. Many radar transmitters and antenna systems located on ships produce electromagnetic energy levels (radio frequency radiation) which may endanger human health; such as, damage to body tissue by heat or ionized radiation, and which may activate electrically initiated ordnance devices or ignite combustible materials by producing radio frequency sparks. Although the electric shock caused by R-F potentials induced in various metal objects that may be contacted by personnel is usually insufficient to electrocute personnel directly, the shock could cause an involuntary reaction resulting in a fall from an elevated position. Examples of metallic objects that may have sufficient R-F voltage induced into them to constitute an electrical shock hazard are smokestack guys; davit head spans; railings; metal parts of wooden masts not effectively grounded; aircraft; and lengths of wire cable or hawser, especially when the lengths approach resonance to an R-F frequency as the cables or hawsers are reeled in or out.

3. WORKING WITH OR NEAR METALLIC OBJECTS IN R-F ELECTROMAGNETIC FIELDS. Personnel should be alert at all times to the possibility of eleetrical shock from any of the potential areas. In addition, the following specific precautions will be taken:

a. All equipment will be grounded, including aircraft, as instructed.

b. All objects will be grounded as logic or experience has indicated to be advisable, noting however, that single ground, or even several grounds, does not necessarily provide an R-F ground for all surfaces of a large metallic object such as an aircraft.

4. WORKING IN OR NEAR HIGH DENSITY R-F FIELDS. If the power density of R-F electromagnetic fields is sufficiently high, human body tissue and sensitive organs; such as the eyes, are susceptible to damage by heat or ionization. While many factors influence the determination of a biologically hazardous level of power density, at present a level of 10 milliwatts per square centimeter for continuous exposure is considered to be the threshold of potentially dangerous R-F radiation. For intermittent exposure (antenna rotating and/or scanning), an incident energy level of

MT-PWHD-005514

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J-M 83

300 millijoules per 3-second time period is considered the maximum. Power densities approaching or exceeding these figures are found primarily in the highly concentrated narrow beams of the high gain antennas used for radars. Possible sources of high powered density are wave guide openings and feed horns during servicing or repair operations. The following precautions will be taken to ensure that personnel are not exposed to power densities exceeding the safe working level:

a. Prior to any visual inspection of feed horns, open ends of wave guides or any opening emitting high energy R-F electromagnetic energy, the equipment shall be secured for the purpose of such an inspection.

b. Dummy loads will be used where applicable as a load for equipment during testing or check-out rather than discharging the energy into the surrounding atmosphere.

c. Aircraft employing high power radar will be parked, or the antenna rotated, so that the beam is directed away from personnel working areas.

d. When operating or servicing a shipboard radar, all R-F radiation hazard signs posted in the operating area will be observed to insure that the radar is operating in such a manner that personnel on deck or in the superstructure are not subjected to hazardous levels of R-F radiation.

e. All personnel will observe R-F HAZARDS warning signs which point out the existence of R-F radiation hazards in a specific location or area.

f. All personnel assigned full time, or whose primary duties involve the repair, calibration or maintenance of radar equipment, shall be examined in accordance with BUMEDINST 6260.10A.

g. Minimum safe distances from radar antennas will be maintained by all personnel. The minimum safe distance from specific radar antennas and the maximum exposure time within these distances under certain modes of operation are listed in the Radio Frequency Hazards Manual, NAVWEPS 16-1-529, and NAVSHIPS Technical Manual, Chapter 9670.

5. SAFETY PRECAUTION FOR WORKING ALOFT AND ENERGIZING OR ROTATING ANTENNAS. Whenever a transmitting antenna is energized, personnel in the vicinity are subject to the dangers of electric shock, physical dislodgement from masts, and exposure to micro-wave transmission. Therefore, the following precautions will be strictly adhered to:

a. Work Aloft.

(1) Where employees must pass near or work in the vicinity of energized or rotatable antennas, the cognizant supervisor will notify the Officer of the Deck and request that antenna power be turned off at the safety switch in the antenna pedestal, or by de-energizing and tagging

MT-PWHD-005515

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J-M 83

the proper circuit below deck, and obtain assurance that this has been done. Personnel shall not pass within the rotating circle of the antenna until this has been accomplished. Supervisors for shops involved in such work aloft will have approved danger tags available which the Officer of the Deck will be requested to attach to radar electrical control equipment and radio transmitters, prohibiting its use until work aloft has been completed and the tag removed. Cognizant supervisors will report completion of such work to the Officer of the Deck and will collect danger tags.

(2) When work is to be accomplished on electrical equipment aloft, the supervisor will arrange with the Officer of the Deck to insure that the switch controlling power to the equipment involved is sealed "OFF" with signed tag, which will not be removed by any person other than the signer or authorized supervisor.

(3) No supervisor will send an employee aloft until he has notified the Officer of the Deck that work is to be undertaken and has requested and received assurances that energizable or rotatable antennas will not be operated until work is completed.

(4) Employees will not go aloft until they have notified the O.O.D. of their intentions.

b. Energizing or Rotating Antennas. If at anytime it becomes necessary to energize or rotate on antenna, the following actions will be taken:

(1) Operating personnel will obtain permission from the Ship's Officer of the Deck to energize or rotate specific antennas and indicate the estimated length of time required to complete the operation.

(2) The Officer of the Deck will not permit energizing or rotation until:

(a) Antenna danger signs are posted in plain view on all ladders leading to the mast or rigging area in the vicinity of the antennas to be energized or rotated. These signs will be delivered to the ship by the cognizant Ship Superintendent. They will contain the wording DANGER - ENERGIZED or ROTATING ANTENNAS - STAY CLEAR.

(b) Workmen who are aloft in the rigging or on the mast at the time signs are posted, or any other personnel in the danger area, are cleared to a safe area. Additionally, the OOD shall determine if any other ships or cranes are within the minimum safe distance as set forth in NAVWEPS 16-1-529 and NAVSHIPS Technical Manual, Chapter 9670. If any ships/cranes are within that distance, cognizant

shipboard or crane personnel shall be notified before the radiating system is energized, and notified again at the conclusion of radiation. It must be clearly understood that high powered radars often have minimum safe distances of several hundred feet. It is imperative that these distances be known by the OOD before radiation, and that all personnel within the minimum safe distance be removed, both in the radiating ship and on other nearby ships or cranes.

(3) At the conclusion of operations, equipment will be secured, the antenna danger signs removed, and the OOD notified of the actions.

(4) Shipyard personnel will comply with the instructions of those authorized to rotate or energize antennas and will stay clear of all masts and rigging areas where the danger signs have been posted. Any personnel working in the vicinity of the "rotating type" antennas after the area has been declared safe who find that the antenna has been "accidentally" energized or is being rotated, will immediately leave the area and report the incident to the OOD.

REDACTED
J-M 83

MT-PWHD-005517

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(3) Aircraft employing high power radar shall be parked or the antenna rotated so that the beam is directed away from personnel working areas.

(4) Ensure that radar antennas which normally rotate are rotated continuously while radiating, or are trained to a known safe bearing

(5) Train and elevate non rotating antennas away from inhabited areas while radiating.

(6) When it is necessary to radiate hazardous levels of rf energy, appropriate rf warning signs shall be posted and entrance into such areas shall be prohibited (see article 1501.10e).

(7) Minimum safe distances from radar antennas shall be maintained by all personnel. The minimum safe distances from specific radar antennas and the maximum exposure time within these distances under certain modes of operation are listed in NAVWEPS 16-1-529 and NAVSHIPS 0900-005-8000. The distances and times apply only to areas that are in or near the main beam of the antenna.

b. Hazards Due to Electrical Shock in RF Fields. RF potentials induced in metal objects may be sufficient to cause electric shock when contacted by personnel. Although usually insufficient to electrocute personnel directly, the shock may cause the person involved to react violently and thereby cause injury due to falling or striking some object. Examples of metallic objects that may have sufficient rf voltage induced in them to constitute an electric shock hazard are as follows:

Smokestack guys
Railings
Aircraft
Lengths of wire cable
Antennas

Personnel working near such objects should be aware of the potential hazard and grounding the objects if possible. It should be noted that a single ground, or even several, do not necessarily provide an rf ground for all surfaces of a large metallic object.

2. Hazards to Flammable Vapors. The increase in radiated rf energy from high powered communications and radar installations now used in the Navy has increased the potential hazard of rf induced ignition of flammable liquid air mixtures. The possibility of such ignitions is dependent upon the existence of optimum conditions involving vapor-air mixture proportions, proximity of flammable liquid handling operations to the radiating source, configuration of equipment involved, and frequency and power of the rf radiation. Detailed discussion of these optimum conditions and appropriate precautions are contained in NAVSHIPS 0900-005-8000. Although this NAVSHIPS manual is concerned primarily with the hazards and precautions pertaining to aircraft fueling operations aboard ship, the principles and procedures are generally applicable to the assessment of flammable liquid handling operations ashore.

3. Hazards to Ordnance. Radio frequency electromagnetic radiation can cause accidental firing of electroexplosive devices used for initiating booster rockets, warhead detonation and other purposes. Grounding or shorting of the electroexplosive device is not sufficient to assure safe handling in areas where rf electromagnetic radiation exists. The precautions to be followed in avoiding such accidental ignitions are contained in NAVWEPS 16-1-529.

1544. X-RAY RADIATION HAZARDS FROM HIGH VOLTAGE ELECTRONIC EQUIPMENT

1. Hazardous Voltage. When high velocity electron beams strike metal or certain other materials, X-rays are produced. The operation of some electronic devices depends on the acceleration of electrons, and when the accelerating voltage approaches or exceeds 15,000 volts the production of X-rays may become a hazard to personnel. Examples of such electronic devices are magnetrons, klystrons, thyratrons, cathode ray tubes and high voltage rectifier tubes. Currently, tubes are about the only electronic equipment that use sufficient voltage on these devices to constitute a hazard. The

MT-PWHD-005518

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J-M 83

X-rays produced by accelerating potentials in the order of 15,000 volts are not hazardous beyond a foot or so from the source and do not require elaborate shielding to make the device safe for nearby personnel. However, as the accelerating potentials become greater than 15,000 volts, the X-rays produced have much greater energy and the difficulty of providing adequate shielding increases appreciably.

a. Servicing Electronic Devices That Produce X-ray Hazards. When performing preventive or corrective maintenance on electronic devices that produce hazardous X-ray radiation as an undesirable by-product, the following precautions should be observed by maintenance personnel:

(1) Observe all warning signs on the equipment and all written safety precautions in the instruction manuals for the equipment that deals with X-ray hazards.

(2) Do not use jumper interlocks that permit the servicing of operating equipment with the protective X-ray shielding removed, unless such procedures are called for in the instruction manuals.

(3) Be sure to replace all protective X-ray shielding when servicing is complete, so that operating personnel or others will not unknowingly be subjected to harmful X-ray radiation.

(4) When bench testing X-ray producing electronic devices be sure that adequate X-ray shielding is provided to protect all personnel in the testing area.

(5) Determine the latest safety precautions to be observed by maintenance personnel, including the use of the latest approved dosimeters, by consulting the ship's safety officer on shipboard or the industrial hygienist at shore installations.

1545. WORKING ON ANTENNAS

1. **Cautions to Personnel.** Supervisors shall caution all men not to venture or work close to an exposed radio or radio antenna unless it is first determined from the proper authority that the antenna is not and will not be energized. (See also article 1543.)

2. **Danger From Rotating Antennas.** Radar and other antennas which rotate or swing through horizontal or vertical arcs may cause men working aloft to fall. Therefore, the motor switches which control the motion of these antennas should be secured or locked in the open position and suitably tagged before men are permitted to ascend or go within reach of the antenna.

3. **Antenna Poles.** To secure antenna pole guys, see Chapter 8 for rigging precautions and wire rope safety.

4. **Aircraft Antennas.** Before operating transmitters in aircraft, inspection shall be made of the antennas to insure that they are not touching fabric-covered portions of another aircraft parked nearby, and are not within hazard range of personnel, fuels, or ordnance. (See article 1543.)

5. **Safety Belts.** Safety belts shall be worn by all personnel climbing radio antenna towers and radiators and other types of towers over 30 feet high. Where ladder climbing safety devices are provided on such towers, a special safety belt shall be provided with an appropriate connection and shall be used by workmen when ascending or descending the tower. Such a special safety belt and connection shall be in accordance with specifications given in the *Safety Equipment Manual, NAVEXOS P-422*. Except when the ladder safety device is used, the safety belt shall be tied off to a life line at all times if it is physically practicable to do so.

6. **Antenna Tower Ladders and Platforms.** Fixed ladders and platforms on antenna towers of all types shall be constructed in accordance with the latest issue of USA Standard, *Safety Code for Fixed Ladders,* A14.3.

1546. CATHODE RAY TUBES

Cathode ray tubes are highly evacuated. These tubes shall be handled with extreme care. If a cathode ray tube is broken, the relative high external pressure will cause the tube to implode (burst inwardly), which will

MT-PWHD-005519

0008 1201 REDACTED J-M 83

result in metal parts and glass fragments being expelled violently.

1. Handling. In handling, the tube shall be removed and replaced in the packing box with extreme caution (do not drop). The tube face, particularly the rim, must not be struck, scratched, or subjected to more than moderate pressure. When a cathode ray tube is removed from a unit, it should not be allowed to remain exposed to damage or shock on work benches, etc., but should be immediately placed in the container provided for that purpose or in the container that held the replacement tube.

2. Maintenance. Maintenance or installation personnel shall wear safety glasses and gloves when handling cathode ray tubes. When removing or inserting tubes in equipment sockets, use only moderate pressure; do not jiggle the tube or stand directly in front of the tube face. Any securing clamp around the rim or face of the tube shall be carefully secured.

3. Disposal. Defective tubes shall be stored or destroyed in such a way that no danger results to personnel. In addition to the danger involved in implosion, the inner coatings of some tubes are poisonous if absorbed into the blood stream.

1547. RADIOACTIVE MATERIALS USED WITH RADIAC EQUIPMENT

There is a large variety of types and sizes of radioactive material used in calibrating or checking radiac equipment. The use of the larger sources is restricted to authorized radiac repair facilities. Smaller sources, although also of possible danger, are supplied with equipment for the purpose of field checking the instruments. Proper use or handling of these sources is covered in the technical manuals for the equipments with which they are supplied. If these instructions do not cover the proposed use of the source under consideration, its proposed use should be referred to local health or safety personnel. Even in storage, radioactive materials may be harmful to personnel and may expose unprocessed photographic and radiographic films and papers. Precautions must therefore be observed constantly to protect personnel and vulnerable materials from these radiations. More detailed information on the handling and storage of radioactive material and the safety precautions to be observed is contained in *NAVMED P-5055, Radiation Health Protection Manual*, and Bureau of Ships Instruction 9763.14A.

1548. ELECTRON TUBES CONTAINING RADIOACTIVE MATERIALS

Some electron tubes contain a significant amount of radioactive material and are marked in accordance with military specification MIL-M-19590. The hazard of handling individual electron tubes containing radioactive material is primarily that of contamination of personnel and surrounding material with radioactive fragments resulting from breakage. In the event of breakage, approved methods of monitoring, decontamination, and disposal shall be employed. Under no conditions should unauthorized persons handle broken or unbroken electron tubes containing radioactive material. Broken and useless tubes containing radioactive material, such as radiac spark gap, TR, glow lamp, or cool cathode tube should be treated as any other radioactive waste material and disposed of in accordance with instructions contained in NAVMED P-5055.

1549. SONAR

All operating sonar equipment is capable of causing physiological injury to divers and swimmers in their vicinity. To prevent such injuries, safe distances and staying times are promulgated in certain classified NAVSHIPS directives. These directives shall be consulted when conducting diving operations in the vicinity of operating sonar sets.

MT-PWHD-005520

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J-M 83

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LBNS SAFETY SUPPLEMENT NO. 1549.1

Subj: Sonar Hazards to Divers

1. POLICY. To reduce the probability of physical and physiological injuries to divers, all ships berthed in the area of diving work will be advised of safety precautions required and will exercise such precautions during the time diving work is underway. In addition, the movement of ships, yard craft, camels, floats and punts which constitute a hazard to divers will be eliminated in those areas where diving operations are in progress.

2. INFORMATION. In an effort to increase the effective range of shipboard sonar equipment, the transmitted power has been increased, resulting in higher acoustic pressures that constitute a hazard to personnel working underwater. This physiological hazard is acoustic in nature; i.e., it is related to water pressure and has no relation to electric or electromagnetic shock.

a. Safe operating distances for personnel performing underwater work are contained in NAVSHIPS INSTRUCTION 09940.14A of 19 July 1968. These distances are the result of experiments with AN/SQS-26 sonars. However, as other sonars have not been investigated under the same experimental conditions, these distances must also be used for all other sonars. Examples of minimum safe working distances are listed below:

Unhooded Divers	180 yards
Divers Suited or Wet Suited with Hoods	38 yards

b. Of more immediate personal danger is the operation of specific pieces of machinery aboard ship while diving operations are in progress. Such items definitely jeopardize the physical safety of a diver. Principal among these are the rotating of propellers, discharging through any underwater discharge lines and operation of sea suction equipment.

3. NOTIFICATION TO SHIPS OF IMPENDING DIVING OPERATIONS.

a. The Production Department (Service Group) will prepare an original and four copies of the "Preparation and Safety Precautions for Diving Services" (11ND-NSYLB-5100/8) for each incident involving the service of a diver, indicating the date and approximate time that the diving work will begin. Copies will be distributed to each ship berthed in the immediate vicinity of the diving area. The original and two copies of the form will be delivered to the respective ships by the Shop 72 Diving Supervisor; one copy will be forwarded to the Berthing

1911

MT-PWHD-005521

REDACTED
J-M 83

Superintendent (Code 340.1); and the fourth copy will be retained in the shop office for record purposes at least thirty days.

(1) The Commanding Officer (or his authorized representative), the Engineering Officer and the Operations or Weapons Officer of each ship will acknowledge receipt of the notice and insure compliance with the precautions contained thereon by endorsement. The ship will return the original to the diving supervisor, deliver one copy to the Ship Superintendent and retain the second copy.

(2) Those ships to which Ship Superintendents have not been assigned will route an acknowledged copy of the "Preparations and Safety Precautions for Diving Services" to the Berthing Superintendent.

b. All other ships within the prescribed safety area will be notified via verbal communication by the Production Department (Service Group) when diving operations are to begin.

c. The Shop 72 Diving Supervisor will notify ships in the safety area of emergent diving operations, and the Berthing Superintendent. This notification will be communicated verbally.

4. RESPONSIBILITIES.

a. Production Department (Shop 72) will prepare and distribute Form 5100/8 in accordance with paragraph 3. above; make verbal notification to all ships in the safety area of the exact time diving operations will commence and when the operations are completed; verbally notify ships in the safety area of incidents of emergent diving requirements; and ascertain that the Berthing Superintendent is cognizant of information needed to insure ship operations are secured during diving operations.

b. The Ship Superintendent (Code 331/332/333) will insure that ship operations which jeopardize the safety of a diver are secured during the period of the diving operation.

c. The Berthing Superintendent (Code 340.1) will notify Port Services and the Public Works Department to restrict movement of yard crafts, camels, punts and floats in the area where divers are operating and advise these offices when diving operation is completed; notify by telephone those ships arriving after issue of the diving notice of the precautions required.

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J-M 83

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LBNS SAFETY SUPPLEMENT NO. 1549.2

Subj: Safety Requirements for Work Associated with Pressurized Rubber Window Sonar Domes

Encl: (1) Medical Aspects of Hyperbaric Safety
(2) Sample General Log and Repetitive Entry Table

1. PURPOSE. The purpose of this supplement is to promulgate the necessary requirements for insuring the safety of personnel engaged in the installation, testing, maintenance, and operation of rubber window sonar domes (AN/SQS-23 and AN/SQS-26 type) and associated equipment.

2. PRECAUTIONS.

a. Work in Pressurized Environment. When any type work is to be performed in an air pressure of fifteen (15) psig, the following safety precautions shall be adhered to:

(1) General.

(a) The cognizant supervisor shall make sure that all personnel assigned to work in the pressurized environment as well as those on watch at control valves, gages, and phones are thoroughly familiar with the operating instructions and the appropriate measures to be taken in various types of emergencies.

(b) Battery powered portable lighting should be made available and used at all times in the dome area. If the need should arise, 115 volt power is available in the dome area; when using 115 volt power, only approved inspected waterproof equipment should be used. DO NOT USE 115 VOLT POWER UNLESS THE DOME IS COMPLETELY DRY.

(c) The maximum number of personnel to be admitted to the dome, and normally only three are necessary, shall not exceed the number that can enter or exit through the airlock at any one time. When the work is completed at least two (2) persons shall leave on the last exit.

(d) When personnel are working in the dome, all involved support systems (air, electrical, etc.) shall be properly tagged to preclude accidental interference.

(e) Action shall be taken to keep all ships and craft away from the bow dome area.

(f) At least one of the personnel assigned to work in the pressurized dome shall be in constant telephone communication with the watch on duty outside. The watch station outside shall be manned at all times when personnel are inside the pressurized area.

MT-RWHD-005589

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J-M 83

(2) Fire.

(a) Smoking or the use of open flame in the pressurized environment is prohibited!

(b) Personnel shall remove matches, cigarette lighters, and smoking material from their person before entering the pressurized environment.

(c) The use of flammable material is forbidden.

(3) Work Qualifications. Only authorized personnel will be permitted to enter the pressurized environment. In order for authorization to be granted, the following criteria must be met:

(a) Assignment must be made, in writing, by cognizant Shop or Office Head.

(b) Individual must be declared "physically qualified" to enter pressurized dome by Senior Medical Officer in accordance with enclosure (1).

(c) Individual must receive appropriate training from the Safety Division.

These requirements must be met in the order given. Enclosure (1) contains specific medical and training requirements considered necessary for personnel working within pressurized rubber window sonar domes. Enclosure (2) has been developed and provided specifically for use in accordance with paragraph 7. of enclosure (1).

b. Anti-foulant Rubber. The anti-foulant (NOFOUL) rubber used in AN/SQQ-23 and AN/SQS-26 type Sonar domes contains a substance called "TBTO." This type rubber is a relatively safe material when used with reasonable caution. When handling/installing sonar dome windows containing TBTO rubber, the following precautions will be taken:

(1) Gloves will be used in handling the TBTO rubber and skin contact should be avoided. Employees handling this type of rubber should practice good personal sanitation. Washing of any exposed body surface to which this rubber has come into contact should be done at the end of each work swift.

(2) In all enclosed spaces where either vapors or dust of TBTO rubber may exist, sufficient exhaust or positive ventilation will be provided. In general, respiratory protective devices are not needed for operations involving the maintenance or repair of equipment around TBTO rubber provided good ventilation is present.

MT-PWHD-005524

(3) When grinding or buffing TBTO rubber, goggles or face shields will be worn. A respirator for protection against acid gasses and organic vapors should be worn. This is the respirator using the yellow color coded cartridge. If dust gets in the eyes, the eyes should be flushed with water for fifteen (15) minutes and the employee sent to the Dispensary.

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J-M 83

MEDICAL ASPECTS OF HYPERBARIC SAFETY

Pressurized Rubber Window Sonar Domes

1. GENERAL. Numerous hazards are inhernet when working under greater than one atmosphere of pressure. The effects of pressure on the body can be divided into primary and secondary phenomenon; the former includes the mechanical effects of pressure upon the body cells and spaces, the latter covers the physiological effects.

a. Effects of Pressure Applied Equally to All Parts of the Body. The body is capable of withstanding very large pressures because it is entirely (with the exception of its air spaces) made up of fluids and solids which are essentially incompressible and therefore freely transmit pressure.

b. Effects of Pressure Applied Unequally. If for any reason, one or more of the rigid air spaces in the body is prevented from equalizing with the outside pressure, damage may result. A pressure as small as one pound per square inch can begin to alter the noraml shape of tissues by causing congestion, swelling, and bleeding of the tissues. If the pressure difference is allowed to continue and increase, then actual destruction of the tissues as well as pain and shock could result.

c. Indirect Effects of Pressure (Physiological). As you increase the pressure of air, the partial pressure of each component gas is increased. This increase in the partial pressures will have two types of effects. The first effect will be that the total amount of gas in solution in the body will increase. This will cause problems as the pressure is decreased. The excess gas in solution may leave the solution as bubbles. These bubbles of gases cause decompression sickness. The second type of effect comes on with gases (such as oxygen, nitrogen, and carbon dioxide) which not only go into solution but have specific actions on the body. These actions are not noticeable under ordinary conditions; however, they will increase (sometimes causing nitrogen narcosis and oxygen poinsoning) when the pressure is sufficiently increased.

MT-PWHD-005526

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J-M 83

2. EFFECTS OF PRESSURE DURING DESCENT.

a. The Ears. The eardrum is located between the external ear canal and the middle ear space. The eardrum completely isolates these two areas from each other. As pressure is applied to the body, the outer eardrum surface is subject to this same pressure. To counterbalance this increase in pressure, air must pass through a narrow tube (the eustachian tube) between the middle ear space and the throat. Should this tube become blocked by mucus or an overgrowth, the equalization cannot take place and severe pain will result. If pressure continues to increase actual rupture of the eardrum will occur. Also since the blood vessels will transmit the full external pressure and the internal pressure of the middle ear is lower, hemorrage of the middle ear may occur before the eardrum ruptures. Returning to normal pressure will bring immediate relief. Very often a slight blockage of the eustachian tube can be overcome by holding the nose and lips tightly and exerting inside pressure by forced expiration. Yawning, swallowing, and movement of the jaw may also be helpful in opening the eustachian tube.

b. The Sinuses. All sinuses are located within hollow spaces in the skull bones. These cavities are lined with a mucus membrane continuous with that of the nasal cavity. If any of the sinuses are blocked by mucus or tissue growths, pain will soon be experienced in the obstructed area when pressure is applied. The situation will be very much like that described for the middle ear. Unless damage has already occurred, a return to normal pressures will bring about relief.

c. Teeth. If a tooth becomes painful during descent, this suggests the presence of a small gas pocket in the pulp or in a part of the tooth where soft tissues can experience squeeze.

3. EFFECTS OF PRESSURE DURING ASCENT

a. Air Embolism. This problem is a result of the expansion of the air inside the lungs. The immediate cause is holding the breath during ascent. For example, if an individual ascends to the surface from 33 feet (15 psi), the air within his lungs will expand to two times it original volume. If this expanding air fills the lungs completely and is not allowed to escape, a pressure is built up within the lungs which is greater than the pressure surrounding the chest. This pressure overexpands the lung and ruptures its air sacs and blood vessels. It is an absolute rule always to breach normally and continually during ascent.

MT-PWHD-005527

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J-M 83

b. Overexpansion of the Stomach and Intestine. While a man is under two atmospheres of pressure, gas formation may take place within his intestines, or air may be swallowed and trapped in his stomach. During ascent this trapped gas expands and occasionally causes discomfort. This may cause him to stop the ascent until it can be expelled. Continued ascent in spite of marked discomfort may result in actual harm. Chewing of gum can cause air to be swallowed and will not be allowed.

4. POLICY. With the advent of the new sonar domes being installed on ships equipped with AN/SQS-26 type sonar systems, new problems have surfaced. These problems have been well researched by Naval Ship Systems Command, Naval Ship Engineering Center, Bureau of Medicine and Surgery, and U. S. Navy Experimental Diving Unit. NAVSHIPS 0967-447-1010 provides preliminary information operating instructions and principles of operation. Some of the possible hazards have been addressed in the foregoing paragraphs. Therefore, all Group Superintendents, Shop Heads, Department Heads, and Office Heads will take action to insure that personnel under their cognizance, working in a pressurized rubber sonar dome are properly instructed in all safety precautions and preventive measures described below. In addition, they will insure that all instructions are adhered to at all times.

5. TRAINING. The Safety Superintendent will conduct mandatory training lectures concerning the safety aspects of working under two atmospheres of pressure. These lectures will, as a minimum, include all the information contained in this Supplement. Department Heads and Office Heads will insure that all personnel have completed this mandatory training prior to working in the pressurized domes.

6. PHYSICAL EXAMINATIONS

Those employees who will be working in pressurized rubber sonar domes must have a physical examination (for persons working under pressure) annually. This examination will be conducted using Appendix F of the U. S.Navy Diving Manual. Employees are encouraged to report any symptom or condition which might interfere with or prevent them from entering the pressurized dome. An employee who, for any reason, seriously desires not to enter the pressurized dome will not be required to do so.

MT-PWHD-005528

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I-M 83

The Medical Officer must insure that an employee is fit to enter the pressurized dome. Therefore, the employees immediate supervisor must, just prior to entry, determine by inquiry of the employee, if any of the following conditions exist and send the man to the Medical Officer if any of the following conditions exist:

a. The employee feels unfit.

b. The employee has any degree of alcoholic intoxication or evidence of its after effects.

c. The employee has any respiratory or middle ear diseases.

d. The employee has any external ear infections.

7. TIME LIMITATIONS

a. One Time Entries. According to the U. S. Navy Diving Manual, a person may be subjected to pressures of up to 15.58 psig for up to 310 minutes without having to undergo any decompression stops on the way back to 0 psig. In order to be sure that there is no reason for decompression stops, employees will be limited to 240 minutes under the 15 psig pressure.

b. Repetitive Entries. Any entry performed within 12 hours of the exiting from the last entry is a repetitive entry. The period between the exit and the next entry is known as the surface interval. To determine the amount of time an employee may spend in the pressurized dome, the Surface Interval Credit Table for Repetitive Entries (Enclosure (1), page number 1549.2-6), must be used. An employee enters on the table the amount of time in the dome and gains from the table his new time from which he must determine his remaining time in the pressurized dome.

c. Over Pressurization. If for any reason the pressurization system fails and the pressure rises above 20 psig, the employee is to immediately report to the Shipyard Dispensary upon leaving the pressurized dome. A man can be subjected to 45 psig for up to 20 minutes without suffering any need for decompression stops. As the pressure increases, the time allowed must decrease.

MT-PWHD-005529

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J-M 83

8. GENERAL RECORD LOG

a. Each employee working in a pressurized dome will maintain a General Record Log (11ND-NSYLB-5100/23) of his entries.

b. Each employee's immediate supervisor will check each man's log for correctness at the end of each shift. A new sheet will be used for each shift in which an employee enters the pressurizing dome.

c. Enclosure (2) page number 1549.2-11. is an example of a properly filled out log. It will be noted that the employee has completely exhausted his 240 minutes and therefore must wait 12 hours before re-entering the dome.

9. FORMS. General Record Log (11ND-NSYLB-5100/23) is available from Code 185.

GENERAL RECORD (TYPE I)
1 IND-NSYLB-5100/23 (10-73)

NAVSHIPYDLBEACHINST 5100.27C
1 October 1973

EMPLOYEE ENTRY LOG

EMPLOYEE: W. J. Door | BADGE NO.: 177602 | PERIOD COVERED FROM 1/25/73 TO 1/25/73

COLUMN CAPTIONS	ENTRIES							
	1st	2nd	3rd	4th	5th	6th	7th	8th
TIME OUT OF THE DOME	09:25	10:30	13:15	16:00				
TIME IN TO THE DOME	08:15	09:50	13:00	13:25				
ELAPSED TIME	1:10	:40	:15	2:35				
REPETITIVE ENTRY ALLOWANCE AT THE END OF THE LAST SURFACE INTERVAL		85	60	85				
REPETITIVE ENTRY ALLOWANCE AT THE BEGINNING OF THE SURFACE INTERVAL	70	125	75	240				
SURFACE INTERVAL	0:25	2:30	:10					
REPETITIVE ENTRY ALLOWANCE AT THE END OF THE SURFACE INTERVAL	85	60	85					

SIGNATURE OF EMPLOYEE: W.J. Door

SUPERVISOR SIGNATURE CERTIFYING THAT HE HAS CHECKED THIS LOG SHEET: G. F. Mann

REMARKS

REDACTED
J-M 83

SAMPLE

Enclosure (2)
1549.2-11

MT-PWHD-005531

0008 1213

REDACTED
J-M 83

SURFACE INTERVAL CREDIT TABLE FOR REPETITIVE ENTRIES

Repetitive entry allowance at end of the surface interval

Repetitive entry allowance at the beginning of the surface interval from previous entry

	240	205	170	150	125	110	85	75	60	50	30	20	10	
220	0:10 0:25	0:26 0:42	0:43 0:59	1:00 1:18	1:19 1:39	1:40 2:05	2:06 2:34	2:35 3:09	3:09 3:52	3:53 4:49	4:50 6:18	6:19 9:28	9:29 12:00	*
	190	0:10 0:26	0:27 0:45	0:46 1:04	1:05 1:25	1:26 1:49	1:50 2:19	2:20 2:53	2:54 3:36	3:37 4:35	4:36 6:02	6:03 9:12	9:13 12:00	*
		160	0:10 0:28	0:29 0:49	0:50 1:11	1:12 1:35	1:36 2:03	2:04 2:38	2:39 3:21	3:22 4:19	4:20 5:48	5:49 8:58	8:59 12:00	*
			140	0:10 0:31	0:32 0:54	0:55 1:19	1:20 1:47	1:48 2:20	2:21 3:04	3:05 4:02	4:03 5:40	5:41 8:40	8:41 12:00	*
				120	0:10 0:33	0:34 0:59	1:00 1:29	1:30 2:02	2:03 2:44	2:45 3:43	3:44 5:12	5:13 8:21	8:22 12:00	*
					100	0:10 0:38	0:37 1:06	1:07 1:41	1:42 2:23	2:24 3:20	3:21 4:49	4:50 7:59	8:00 12:00	*
						80	0:10 0:40	0:41 1:15	1:16 1:59	2:00 2:58	2:59 4:25	4:26 7:35	7:36 12:00	*
							60	0:10 0:45	0:46 1:29	1:30 2:28	2:29 3:57	3:58 7:05	7:06 12:00	*
								50	0:10 0:54	0:55 1:57	1:58 3:22	3:23 6:32	6:33 12:00	*
									40	0:10 1:09	1:10 2:38	2:39 5:48	5:49 12:00	*
										25	0:10 1:39	1:40 2:49	2:50 12:00	*
											15	0:10 2:10	2:11 12:00	*
												5	0:10 12:00	*

Instructions for Use

Surface interval time in the table is in hours and minutes (7:59 means 7 hours and 59 minutes). The surface interval must be at least 10 minutes.

Find the repetitive entry allowance at the beginning of the surface interval on the diagonal slope. Enter the table horizontally to select the surface interval times shown. The new repetitive entry allowance will be found at the head of the vertical column. For example, a previous entry was for 52 minutes. The employee remains on the surface for 1-hour-and-45-minutes and wishes to find the new repetitive entry allowance. The repetitive entry allowance at the beginning of the surface interval is 52 minutes. Entering the table at the next largest repetitive entry allowance (60 minutes) and going along the horizontal line labeled "60". The 1-hour-and-45-minute surface interval lies between the times 1:30 and 2:28. Therefore the employee has lost sufficient inert gas to place him in a repetitive entry allowance of 50 minutes.

*Note: Entries following surface intervals of more than 12 hours are not considered repetitive entries.

Enclosure (2)
1549.2-12

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LASER SAFETY

1550. SCOPE AND DEFINITIONS

1. Scope. The following precautions are applicable to laser employed in research and development projects and as utilized in operational equipment and weapons systems.

2. Definition. The term *LASER* is an acronym derived from *L*ight *A*mplification by *S*timulated *E*mission of *R*adiation. Laser sources differ from conventional light emitters in that the light generated is highly coherent (in phase) and concentrated such that high intensities are transmitted at considerable distances. *CW Laser* is *c*ontinuous *w*ave laser as distinguished from a *Pulsed Laser*.

1551. HAZARDS

A number of hazards are associated with the installation and operation of laser devices (see NAVMED P-5052-35, *Control of Hazards to Health from Laser Radiation*):

1. High intensity light radiation can result in:

a. Serious eye injury and burns to exposed body parts.

b. Ignition of flammable or combustible materials and sensitive ordnance components.

2. High voltage in the circuitry of power sources introduces the possibility of:

a. Fatal or injurious electric shock.

b. Explosion of highly charged capacitor banks.

c. Injurious X-radiation from susceptible electronic components operating at voltages in excess of 15,000 volts.

3. Pulsed and exciter electronic circuits of associated equipment may radiate hazardous radio-frequency energy (article 1543).

4. Physical hazards associated with exploding flash lamps, high speed rotating mirrors, toxic gases used in some types of CW gas lasers, and with cryogenic coolants used in devices having very high input energies.

1552. LASER INSTALLATIONS

1. Wherever feasible laser equipment should be located in a room separated from general laboratory areas or contained in a light-proof enclosure. Lasers with power outputs (mega and gigawatt range) exceeding the capabilities of protective devices shall be housed in an area to which personnel will not be allowed access during operation.

2. Laser spaces shall be free of reflective surfaces or objects, particularly in the target area.

3. Work with lasers shall be done in areas of high general illumination, except where accomplishment of a mission would be impaired.

4. A warning sign or signs such as that of Figure 3 of NAVMED P-5052-3 shall be permanently posted at all entrances of the laser enclosure.

5. Pulsed and CW laser installations with reflected intensities exceeding those levels listed in Table 1 of NAVMED P-5052-3 shall:

a. Have safety interlocks at entrances of the laser space such that unauthorized or transient personnel are denied access while the laser power supply is charged and capable of firing. When interlocks are actuated, a fail-safe circuit shall de-energize the laser system within 5 seconds.

b. Have an alarm system including an audible signal and flashing lights (visible through laser safety eyewear) which are actuated when the laser power source is being energized (e.g., capacitor banks begin to charge, CW laser power supply is energized (before laser tube is switched on) or chemical pump energy source is energized).

c. Be free of extraneous reflective surfaces or objects particularly in the target area. Walls and ceilings should be painted with a diffuse nongloss paint, preferably black, near the target area and a light color elsewhere to increase ambient illumination.

MT-PWHD-005533

0008 1215 REDACTED J-M 83

d. Have adequate ventilation where inert liquefied coolant or toxic gases are used in the system.

e. Have a master electrical power shut-off outside the laser enclosure.

1553. LASER EQUIPMENT

1. Electrical and electronic circuits associated with laser apparatus shall be installed in accordance with the applicable requirements of this Chapter and Requirement 1 of MIL-STD-454, *Standard General Requirements for Electronic Equipment.*

2. Firing systems shall be designed with fail-safe controls in order to prevent the possibility of firing the laser accidentally.

3. Laser equipment components that can produce extraneous direct, deflected or reflected radiation of harmful visible, ultraviolet, or infra-red light; X-ray or radio-frequency energy shall be shielded. Flash lamps, rotating parts, capacitor banks, and other components that can fail and thereby produce hazardous flying pieces shall be shielded.

4. A suitable fire-resistant low-reflective material shall be provided as a backstop for the beam of carbon dioxide-nitrogen gas lasers.

5. Safety precautions and safe operating procedures shall be posted in accordance with Chapter 1.

6. Systems employing liquid nitrogen as a coolant shall comply with NAVWEPS OP-3199 publication.

1554. OPERATING PRECAUTIONS

1. Wherever possible aligning the laser beam with the naked eye must be avoided and looking into the primary beam or its reflections is prohibited.

2. Highly portable lasers shall be turned on only after an alignment check.

3. Care shall be taken that the laser beam is not directed at flammable and combustible materials or in the area of sensitive ordnance material.

4. The beam shall be discharged into a non-reflective and fire-resistant background. All extraneous reflective objects in path of beam shall be removed.

5. Laser equipment shall never be left unattended while energized and shall be discharged when shut down.

6. The countdown procedure shall be employed when firing pulsed and CW lasers having reflected intensities exceeding those levels listed in Table 1 of NAVMED P-5052-35.

7. The operation, maintenance, and repair of laser electrical and electronic circuits shall be performed in accordance with the applicable parts of this Chapter.

1555. PERSONNEL PRECAUTIONS

1. During the firing of a laser, personnel shall wear protective eyewear in accordance with the criteria of paragraph 8a(7) of NAVMED P-5052-35. Lenses shall be marked to show the optical density and wavelength for which they are intended to provide protection.

2. Those in charge of laser facilities shall be competent in laser technology and operation. All personnel assigned to work with lasers shall be fully instructed with respect to the hazards involved, safety precautions, and the use of safety devices.

3. Only authorized personnel shall be permitted to set up, adjust, or operate laser equipment.

4. When working on electrical and electronic components of laser equipment, personnel shall observe the safety precautions and use the protective clothing and devices required by this Chapter.

5. When working on liquefied nitrogen cooling systems or when handling the liquefied nitrogen, personnel shall observe the safety precautions and use the protective clothing and devices stipulated in NAVWEPS OP-3199.

1924

MT-PWHD-005534

0008 1216 REDACTED
J-M 83

1556. FIELD PRECAUTIONS

The environmental and operational controls which are practicable in the laboratory, of necessity, may not be feasible under field conditions. However, the precautions listed above and those following should be enforced in laser exercises in the field wherever practicable:

1. The laser should be treated as an ordnance piece, and laser operation and test should be confined to gunnery or missile ranges or other sites where similar security and safety measures are in force.

2. Personnel should be excluded from the beam path to a distance where the energy is within permissible levels. This may be accomplished by the use of physical barriers, administrative control, interlocks, or by limiting beam traverse.

3. Tracking of non-target vehicular traffic or aircraft should be prohibited if within calculated hazardous distances.

4. The beam path should be devoid of objects or area capable of producing hazardous reflections.

5. A permanent log should be maintained, including the date, time, place, type of device fired, bearing of beam, and roster of participating personnel.

MT-PWHD-005535

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J-M 83



1926

0008 1218
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J-M 83

Chapter 16

MEDICAL FACILITIES

1601. HANDLING AND STORAGE OF GASES

Cylinders containing compressed gases such as anesthetic gases, oxygen or other gases used for medical purposes shall be handled and stored in accordance with the following National Fire Protection Association publications:

NFPA No. 56 – *Flammable Anesthetics Code* (NAVMED P-5040).

NFPA No. 565 – *Standards for Nonflammable Medical Gas Systems.*

NFPA No. 566 – *Standards for Bulk Oxygen Systems at Consumer Sites.*

1602. X-RAY DEPARTMENT

The following precautions relate to the construction of X-ray rooms and equipment and their use. For details of maximum permissible exposure see NAVMED P-5055.

1. X-Ray and Control Rooms. X-ray and control rooms shall be located in an area free from dampness and with adequate ventilation and light. The control room shall always be so placed in relation to the treatment or examination room that the operator has a clear view of the latter at all times.

2. Installation and Care of X-Ray Equipment

a. Connections To Power Mains

(1) X-ray installation connections to power mains shall be in accordance with the regulations of the National Electrical Code.

(2) Suitable switches shall be inserted in the lines between transformers, rotary converters or motor generators and the X-ray apparatus.

(3) All X-ray equipment shall be provided with a quick-acting magnetic overload circuit breaker interposed between the transformer and the supply circuit.

(4) High tension generators shall be made inaccessible by means of an insulating barrier or shall be installed in separate rooms.

b. Grounding. All metal parts of X-ray equipment, including tube stands, transformers, tanks, motors, and controls, shall be permanently grounded.

c. Use of X-Ray Equipment In Anesthetic Rooms

(1) All open high-tension generating equipment shall be located in a well ventilated room which is completely isolated from the anesthetic room, and any connecting doors or windows shall be effectively airtight. (The doors should close against soft rubber or felt padding.)

(2) A completely self-contained transformer and X-ray tube unit, in an effectively airtight enclosure, is recommended for use in all anesthetic rooms. Foot switches and all other control devices shall be of a type approved for use in explosive atmospheres. (See the National Electrical Code, and Volume 1 of the National Fire Codes published by the National Fire Protection Association, 60 Batterymarch St., Boston, Massachusetts, 02110.

d. Storage of X-Ray Film. Only film of the slow-burning or safety-base (cellulose acetate) type shall be used. This film presents no greater fire hazard than ordinary newsprint paper in the same form. Should it become necessary to use other than the safety type film, the safety regulations of the National Board of Fire Underwriters applying to the use and storage of nitrocellulose films should be followed.

3. Protection From Direct Radiation

a. X-Ray Tubes. Tubes having built-in protection, or which are in special protective containers, shall be used to replace obsolete installations.

1927

MT-PWHD-005537

0008 1219 REDACTED J-M 83

(1) Enclosure. The protective enclosure shall surround the X-ray tube bulb and the arms for a distance of four inches from the bulb, so that direct radiation is shielded off in all directions. Open bowls shall not be used. The equivalent of 1.0 mm of aluminum shall be permanently mounted between the target and the patient in all fluoroscopic-tube enclosures, and 0.5 mm of aluminum in all radiographic enclosures. Part or all of this aluminum may be contained in the glass of the tube walls. The diaphragm of the tube container shall have a permanent covering of asbestos board at least 0.5 mm. thick placed between the tube and filter, and next to the filter. When the total exposure exceeds previously determined limits, the use of an accumulative timing device is recommended.

(2) Filter. In all therapy work, suitable means shall be provided to prevent accidental omission of a filter.

(3) Applying Tube Voltage. X-ray tubes in shock-proof containers shall never be handled during an operation. The patient shall be positioned, all details arranged, and the operator out of the room before the tube voltage is applied.

b. Personal Protection

(1) Clothing. The medical officer and other X-ray personnel shall be protected from direct radiation.

(2) Use of Protective Tubes. Properly and adequately protected tubes and enclosures, as described above, shall be used.

(3) Control Apparatus. Control apparatus shall be in an adjacent room. If this is impossible the apparatus shall be in a lead-lined booth.

(4) Protective Screens. Movable, upright, protective screens are dangerous and should be replaced by more permanent shielding. Careless handling of this type of screen can make it useless. If portable screens are used, great care must be taken to position them properly.

c. Examinations. All X-ray protective devices, including wearing apparel, shall be examined at least annually for efficient barrier protection.

d. Rotation of Personnel. All persons employed in the X-ray department shall be rotated monthly between duties involving possible exposure and exposure-free work.

4. References. Attention is directed to the following material dealing with the broader aspects of medical X-ray application:

Handbook No. 41, National Bureau of Standards, Washington, D. C.

1603. AMBULANCE SAFETY

1. Equipment. Ambulances shall be in good mechanical condition at all times. All equipment shall be operative and shall be standard according to local practice. Ambulances using public highways shall be equipped with emergency first aid equipment.

2. Permit. Drivers shall have a United States Navy motor vehicle operator's permit, as required by NCPI 5100.9.

3. Briefing of Drivers. Drivers shall be fully conversant with local traffic regulations and local geography. Strict supervision by the transportation officer is essential in this connection.

4. Orders and Accident Forms. Each ambulance shall carry a book or board embodying carefully considered orders and safety precautions prescribed by the local command for the locality, and similar orders shall be posted in the garage. Each ambulance shall carry forms for reporting accidents and the driver shall be instructed as to their use.

5. Observance of State and Local Requirements. All ambulance drivers must satisfy state and municipal requirements as to age and other qualifications.

1928

MT-PWHD-005538

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J-M 83



CHAPTER 17

1929

0008 1221

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J-M 83

Chapter 17

LABORATORIES

1701. GENERAL

1. **Regulatory Difficulties.** Laboratory work by its very nature is not readily adaptable to ordinary safeguards and precautions. Much of the work will be in relatively unexplored fields in which the characteristics or behavior of the subject are yet to be determined. The operator of every test or equipment should carefully analyze the procedure to be followed and should take all necessary steps to protect himself and his fellow workers from any possible accident. Where the nature of the work will permit, the practices listed in this chapter are to be followed in the laboratory.

2. **References.** Detailed information on the use of compressed gas cylinders, various hydrocarbon fuels, cleaners and solvents, radioactive materials, and other subjects related to laboratory work is contained in Chapter 20. No attempt has been made to cover every possible laboratory hazard. Individual laboratories should prepare their own safety precautions to fit specific operations. Chemical laboratories should refer to the Chemical Safety Data Sheets published by the Manufacturing Chemists Association of the United States. Laboratories working with explosives or propellants should refer to NAVWEPS OP 3237, *Explosive, Propellant, and Pyrotechnic Safety Covering Laboratory, Pilot Plant, and Production Operations.*

3. **Inspection.** Laboratory space and equipment shall be inspected at frequent and regular intervals in an effort to eliminate unsafe conditions and prevent unsafe acts before accidents occur. Where new research projects are contemplated, the Safety Officer should be consulted in the planning phases of the project and should inspect the area to insure that prescribed safety precautions have been complied with. A formal report should be submitted after each inspection to the person having cognizance over that area.

4. **Housekeeping.** Good housekeeping is essential for the safe operation of all laboratories. Main aisles and exits shall be free from such obstructions as bottles, boxes, etc. Floors should be clean and free from oil, water, and other material which may cause slipping. Equipment, rags, reagents, etc., should be returned to their proper location immediately after use. All containers must be clearly marked and correctly labeled. Waste shall be deposited in metal containers having self-closing covers. Separate containers shall be provided for broken glassware.

5. **Distracting Attention.** Laboratory employees shall pay strict attention to their work. Employees shall avoid unnecessarily distracting other employees. Equipment requiring constant attention shall not be left unattended.

6. **Horseplay.** Horseplay will not be tolerated in any laboratory at any time. Running is forbidden, except in cases of emergency. Liquefied gases, dry ice, air hose, and knives, for example, should never be used as playthings.

7. **Procedure in Emergencies.** Definite procedures should be established under the guidance of the Safety Officer in each laboratory for the handling of such emergencies as fire, explosion, unexpected release of toxic fumes, etc.

1702. PERSONAL PROTECTION

1. **Clothing.** Suitable clothing for laboratory employees shall be worn in accordance with NAVEXOS P-422, *Safety Equipment Manual.*

1930

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J-M 80

2. Goggles. Laboratory employees shall be required to wear protective goggles or protective face shields when there is any possibility of explosion, implosion, violent chemical reaction, splashing chemicals, injurious radiation, or other occurrences hazardous to the eyes.

3. Showers and Fountains. Deluge showers and eye-flush fountains should be provided if exposures encountered point to possible need for them.

4. Washing Hands. Traces of laboratory chemicals left in contact with the skin may produce dermatitis or severe burns. It is an excellent practice to wash the hands and arms frequently during the course of the day.

5. Gas Masks. An all-purpose gas mask should be available for emergencies. All personnel should be indoctrinated in its use.

6. Monitoring of Air. In cases where toxic materials such as the metals or compounds of barium, beryllium, arsenic, selenium, tellurium, osmium, uranium, thorium, etc., are being handled, a systematic program of monitoring breathing air should be established.

1703. LABORATORY EQUIPMENT

1. Standards. Mechanical and electrical equipment in the laboratory shall conform to standards for installation and guarding as outlined elsewhere in these regulations. If the nature of the work is such that it is impracticable to meet these standards, other precautions shall be taken to prevent injury to personnel.

2. Illumination. Illumination shall be adequate for the type of work being performed, as specified in article 0213. Electrical fixtures and equipment shall be of such design and so located as not to present fire or explosion hazards.

3. Use of Hoods. Laboratory processes which give off toxic vapors or gas shall be vented outside the laboratory. Laboratory work involving toxic materials such as elemental compounds of barium, beryllium, selenium, tellurium, osmium, uranium, thorium, etc., should be performed only in areas with approved hood installations. Flammable vapors and gas shall be vented in such a manner that motors, switches, and lights do not provide a source of ignition. Inhalation of vapors, fumes, gases, and dusts should be avoided by using an efficient fume hood for all work in which such harmful substances are used or formed. A good hood should have air drawn into it at the rate of not less than 100 linear feet per minute. Additional information on ventilation will be found in article 0212.

4. Compressed Gas Cylinders. Compressed gas cylinders shall be stored, handled, and used in accordance with the regulations of Chapter 20.

5. Equipment Under Pressure or Vacuum. Equipment under pressure or vacuum shall not be subjected to pressures in excess of that for which it was designed. If the pressure cannot be predetermined or if there is any possibility of rupture, the operator shall be protected by a suitable shield or screen of sufficient strength to protect him from flying material. Exhausts from mechanical vacuum pumps should be vented to the outside. Inhalation of atomized oil vapor is injurious to the lungs.

6. Laboratory Ovens. Laboratory ovens used to dry samples of explosives or highly flammable materials should have the latches removed from the doors. Chemical compounds or mixtures containing volatile, flammable liquids should be dried in steam or hot water jacketed ovens only.

1704. LABORATORY GLASSWARE

1. Use of Cork Borer. Improper or careless handling of a cork borer can result in very painful injury. The borer should be kept sharp and clean and should always be held in such a manner that a slip cannot result in injury. Under no circumstances should the palm of the hand cover the opposite face of a stopper being bored. The stopper should be

MT-PWHD-005541

0008 1223 REDACTED J-H 83

held firmly with the thumb and forefinger and start the boring with the stopper braced against a soft wooden block or the equivalent. In boring rubber stoppers, wet the borer cutting edge with glycerine or water. Rotate the stopper occasionally during the boring to aid in making a perpendicular hole.

2. Insertion of Tubing in Stopper. Glass tubing should be inserted in a rubber stopper by using some form of lubricant, such as water or thin grease. Lubricants which might react with the contents of the flask should be avoided.

3. Breaking a Tube. When breaking a small-bore glass tube or rod it should first be scratched with a file at the point of the desired break; then, holding the glass in front of the body, with the scratch away from the operator and with the thumbs pressing firmly outward at the point opposite the file scratch, snap quickly with both hands as if snapping a twig. Sharp ends of broken tubing should be fire-polished before using or putting back into stock.

4. Clamps. When setting up glass apparatus it should be clamped just tightly enough to support the weight. All parts should be independently supported in line.

5. Broken Glass. Broken glass should be immediately picked up and discarded in the appropriate receptacle.

6. Chipped or Cracked Glassware. Glassware which has become chipped or cracked should not be continued in use.

1705. ELECTRICAL APPARATUS

1. Standards. Electrical equipment in the laboratory shall be installed, guarded, and operated in accordance with Chapter 15 and shall comply with the requirements of the National Electrical Code.

2. Repairs. All electrical wires and apparatus shall be treated as dangerous and must be worked on by qualified personnel only.

3. Shock. Precautions should be taken against working in a position in which a shock or slip might place the body of an employee in contact with exposed electrical, energized parts.

4. Insulated Floor. Any areas in and around high voltage equipment shall be provided with an insulated floor surface and shall be clearly marked with high voltage warning signs.

5. Artificial Resuscitation. Persons working with or around high voltages should familiarize themselves with artificial resuscitation methods. Where feasible, training in artificial resuscitation methods should be provided on an organized basis (see 1501.12).

6. Interlock System. Where guarding of high voltage equipment cannot be made effective, a suitable interlock system should be used. If the nature of the work is such that an interlock system cannot be used, then personal protective equipment such as rubber gloves, insulated tools, etc., shall be employed with a helper standing by to cut off the power.

7. Burns. High frequency circuits should not be touched, as the arcs may cause deep burns.

8. Connections. Connections shall not be made or broken while the circuit is energized. The power shall first be turned off.

9. High Frequency Fields

a. Stay Clear. Parts of the body shall not be placed in strong high frequency fields. They produce heat at a high rate. The eyes are particularly vulnerable to injury from this type of radiation.

b. Jewelry. Rings, watches, bracelets, and other metal objects should not be worn close to high frequency fields as they may become hot in a short period of time.

c. No Thoroughfare. Areas in or around high voltage equipment shall not be used for thoroughfares, storage space, or working space.

10. Cathode Ray Tubes. Cathode ray tubes must be kept in the original cartons until installed in a piece of equipment (see 1546). Tube mounting operations should be

MT-PWHD-005542

isolated to protect other employees and the operators should wear face shields, leather aprons, and gloves.

11. Electron Beams. High powered concentrated electron beams, which prevail in newly developed equipment for heating, welding, and/or melting, are injurious to the eyes and such beams must not be viewed without protective eye shielding of the proper optical density.

REDACTED
J-M 83

1706. FIRE AND EXPLOSION

1. Vapors. Flammable vapors should be as widely separated as possible from sources of ignition and should not be released into ambient laboratory atmosphere, but only in an adequately vented hood.

2. Extinguishers. The laboratory should be adequately equipped with fire extinguishers of the type suitable to combat the kind of fire which might be expected to occur. (See 0205 for types of fires and extinguishers.) Laboratory employees should be thoroughly instructed in the use of this equipment.

3. Fire Blankets. Laboratories should be equipped with fire blankets and/or safety showers. Their location should be clearly marked and employees instructed in their use.

4. Quantities of Flammable Liquids. Only the amount of flammable or explosive material that is actually required for the

MT-PWHD-005543

REDACTED
J-M 83

day's work shall be brought into the laboratory. A storage area separated from the immediate working area should be provided.

5. **Fume Hoods.** Experiments involving flammables should be preferably conducted in a fume hood. Work of a hazardous nature involving flammables or explosives should never be performed where any resultant fire might block egress.

6. **Exits.** Every laboratory room where hazardous work is performed should have at least two exits as widely separated as practicable.

7. **Gas Burners.** Gas burners should be lighted by flint lighters. Burners should not be left unattended. Rubber tubing for burners should be inspected routinely to assure tight connection and good condition.

8. **Liquefied Gases.** Combustible and toxic gases shall be vented into hoods or the equivalent. Oxidizing gases shall be kept separate from combustible gases.

1707. CHEMICAL STORAGE

1. **Adequate Space.** The storage room should have adequate aisles, a safe, substantial means of reaching high storage spaces, and adequate illumination for the reading of labels.

2. **Ventilation and Fire Prevention.** A door or window opening directly to the outside should be provided, as well as a blower capable of quickly changing the air in the room. If flammable solvents or explosives are stored, the blower as well as other electrical fixtures should be explosion proof. The room should be provided with a fire door and sprinkler system.

3. **Arrangement of Material.** Heavy items should be stored as close to the floor as possible. Material should not be allowed to project beyond the front of the shelving. Chemicals which will react violently with each other should be stored in spaces as widely separated as may be practical. Containers of corrosive chemicals should not be stored on high storage shelves.

4. **Temperature.** Excessive heat or cold should be guarded against where such a condition may cause leakage or a reaction. Do not permit sunlight to shine on volatile liquids or be focused or concentrated by passing through glass bottles placed near the window.

5. **Labels.** All chemicals shall be plainly labeled. Unless materials found in unlabeled bottles can be properly identified, they should be safely disposed of.

6. **Emergency Equipment.** Fire extinguishing equipment and self-contained breathing apparatus should be readily available at chemical storage areas.

7. **Chemicals Requiring Reaction Control.** Chemicals requiring inhibiting agents, liquefied gases in vessels having vent caps, or other materials requiring reaction control should be marked and be easily accessible for inspection.

8. Storage of Flammables

a. **In Refrigerators.** Flammable liquids and volatile solvents shall not be stored in a refrigerator unless the refrigerator is explosion proofed for Class I, Groups C or D, hazardous locations as defined by the National Electrical Code. Domestic type refrigerators listed by the Underwriters' Laboratories as meeting this requirement are available.

b. **In Glass Bottles.** A glass bottle shall not be used to store more than 1 liter of an individual flammable solvent in the laboratory. Flammable solvents required to be kept in the laboratory, ranging in size from 1 liter to 1 gallon maximum, should be stored in metal containers of an approved safety type. Highly volatile materials such as ether should not be stored in the laboratory.

c. **Metal Cabinets.** Flammable liquids used in small quantities in a laboratory should be stored in a metal cabinet. Metal cabinets containing flammable liquids should be clearly labeled on the outside and storage of combustible materials with flammable liquids should be prohibited.

MT-PWHD-005544

0008 1226 REDACTED J-M 83

1708. HANDLING CHEMICALS

1. General

a. Planning. Operations and movements should be planned before handling hazardous chemicals.

b. Mixing. When mixing acid and water, the acid must always be poured slowly into water, not water into acid. Employees should avoid inhaling acid fumes. Any pouring, mixing, or dispensing of acid shall be in a ventilated sink where running water is available.

c. Disposal. Corrosive, highly reactive, or volatile liquids shall not be poured down sink drain pipe. Separate receptacles shall be provided and clearly marked for broken glass, acids, and inert material. Disposal of chemicals, toxic materials and explosives shall be made under the guidance and cognizance of the Safety Officer who shall instruct personnel in the proper procedures for handling, packaging for disposal, storage and transportation. Chemicals of low or no toxicity or low flammability shall be disposed of under the supervision of a competent chemist and/or the Safety Officer (see Chemical Safety Data Sheets, Manufacturing Chemists Association).

d. Catch Pans. Catch pans of suitable design and sufficient capacity should be placed beneath stills during distillation, or when large glass flasks or beakers are heated to prevent possible injury to personnel in case of breakage.

e. Radioactive Materials. Laboratory workers handling radioactive materials shall be informed of the hazards involved. The rules are outlined in NAVMED P-5055 *Radiation Health Protection Manual*.

f. Oxidizing Agents. Strong oxidizing agents must be handled with great care to avoid mixture with easily oxidizable material such as sulphur. When dry, such mixtures may be explosive. Use of a hand pump is the preferred method of transferring chemicals from carboys.

g. Large Containers. Large containers such as carboys should be handled mechanically by tilters or cradles.

h. Protective Clothing. Personnel dispensing or handling chemicals should wear protective clothing (see article 1702).

i. Accidental Spills. Where accidental spills or contamination by toxic substances occur in the laboratory, procedures for clean-up and monitoring of the area is to be under the guidance of the Safety Officer.

j. Toxic Materials. Operations involving toxic materials composed of arsenic, barium, beryllium, cadmium, lead, selenium, tellurium, thallium, etc., or including materials of unknown toxicity should be set up and operated under the guidance of the Safety Officer.

k. Avoid Contamination. Stoppers, glassware or benches contaminated by acids or poisons should not be left where other personnel may touch them. To avoid contact with contaminated surfaces, rinse spillage on glassware or other exposed surfaces immediately.

l. Transporting Chemicals. Safety cans, carts, acid bottle carriers and other safety transport devices should be used to carry chemicals about the laboratory.

2. Specific Hazardous Chemicals.

Except for the following hazardous chemicals and materials used principally in the laboratory, hazardous substances including chemical compounds are covered in Chapter 20.

a. Mercury. Although acute mercury poisoning may result from ingestion of mercury and its salts, the principal hazard in the laboratory comes from its cumulative effects on the system acquired by continuous inhalation of even low concentrations of its vapors and by contact with contaminated equipment and materials. Good housekeeping is, therefore, of prime importance in eliminating the possibility of mercury poisoning.

(1) Containers. Mercury should be kept in sturdy, tightly closed, and clearly labeled containers.

(2) Heating. Mercury should never be heated in uncovered containers unless the immediate area is well ventilated. Mercury baths used for melting point determinations should be kept under a well-drawing hood and the operator must be careful not to inhale the fumes.

1935

MT-PWHD-005545

0008 1227

REDACTED
J-M 83

(3) Filling apparatus. When apparatus is to be filled with mercury, access to the working area shall be restricted. A catch pan containing water about one-half inch deep shall be placed under the filling opening. Every precaution to avoid spilling, such as the use of funnels and rubber tubing, shall be taken.

(4) Decontamination. Mercury spills shall be cleaned up promptly employing the following precautions:

(a) Provide powerful exhaust ventilation.

(b) Gather up as much as possible by careful sweeping or sponging.

(c) Suck up any mercury caught in crevices using a vacuum line or aspirator fitted with a water trap or a vacuum cleaner specifically designed for mercury recovery.

(d) Wash down affected area with a lime-sulphur solution being careful to avoid contacting bare metal surfaces unnecessarily. This treatment will convert any residual traces of mercury to inactive mercuric sulphide which may be swept up.

(e) If a large amount of mercury is spilled (100 cc. or more) and extensive clean-up procedures are required, wear protective clothing and respirators.

(f) Clean-up personnel should finally inspect their clothing for entrapped mercury and then wash thoroughly with soap and water.

(g) Report all spills and accidental contaminations to the Safety Officer who will monitor the clean-up.

b. Perchloric Acid. Perchloric acid presents a formidable fire and explosion hazard, especially when concentrated beyond 76%. Laboratory employees using perchloric acid should familiarize themselves with Chemical Safety Data Sheet No. SD-11, "Perchloric Acid Solution," Manufacturing Chemists' Association. Surfaces and equipment, such as benches, hoods, and exhaust fans, where the solution is frequently used, should be washed periodically to eliminate the accumulation of dry perchloric acid which is readily exploded by impact incident to repairs or by reaction with organic materials.

c. Metallic Sodium and Potassium

(1) Storage. Metallic sodium and potassium should be stored under kerosene or mineral base oil in tin cans. The cans should be inspected periodically and replaced if evidence of leaks or rusting is found.

(2) Disposal. Scrap bits of metallic sodium and potassium should never be discarded in the sink nor thrown into waste cans. Reaction with moisture will cause a fire and violent splattering will result. These metals should be added carefully, in small pieces, to cold alcohol, waiting until all gas evolution has stopped and the solution is complete after each addition. This alcoholate may then be discarded safely in the sink if followed by a generous flow of water.

(3) Fire extinguishers. Fire extinguishers approved for Class D (combustible metal) fires and containing sufficient agent for the amount of metal involved shall be available where extensive use is made of metallic sodium and potassium.

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MT-PWHD-005546

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J-M 83

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J-M 83

Chapter 18
PHOTOGRAPHY

1801. APPLICABLE PRECAUTIONS

This chapter highlights basic safety precautions and instructions which must be observed and followed meticulously when handling photographic supplies and equipment at shore installations. Photographic personnel are required to know and shall follow the detailed safety precautions contained in NAVWEPS 10-1-764: *Safety Precautions for Photographic Personnel.*

1802. THE PHOTOGRAPHIC LABORATORY

The following safety precautions must be followed by personnel working in Navy photographic laboratory areas:

1. **Darkrooms.** Enter and leave dark spaces cautiously, to ward against the possibility of collision with anyone carrying glassware or chemical solutions.

2. **Paper Cutters.** Operate a paper or print trimmer with extreme care and always leave the blade down after each use. Stencil or otherwise mark the face of all trimmers with the following warning: LEAVE BLADE DOWN.

3. **Housekeeping.** Maintain scrupulous housekeeping practices in all areas where chemicals are handled.

4. **Hygiene.** Wash hands thoroughly with an acid-type hand cleaner and rinse thoroughly with water immediately after handling poisonous chemicals; within minutes after possible exposure to dust or fumes; and also several times a day when handling or using poisonous chemicals even though no contact has occurred.

5. **Personal Protective Equipment.** Use approved personal protective clothing or devices whenever applicable. Wash gloves thoroughly and promptly with acid-type hand cleaners and rinse well with water. Clean dust respirators thoroughly and frequently. Scrub rubber face pieces frequently with acid-type hand cleaners and rinse well with water. Launder work clothing frequently.

6. **Ventilation.** Provide adequate ventilation for processing rooms (20 changes per hour.)

7. **Chemical Hazards.** Before handling or using photographic chemicals, become familiar with the detailed precautions for their safe handling as outlined in article 1806.

8. **Smoking.** Do not smoke around film in storage, especially around 35 mm footage, or in areas where volatile solvents are stored or used.

1803. FILM

Safety film (acetate base) is very slow burning, is not easily combustible, and requires no special handling or storage as hazardous material. Nitrate film, however, is highly flammable and under certain conditions explosive. All nitrate film which is serving no present purpose should be destroyed. If it is anticipated that footage or negatives on this type of film will be used in the future, it should be duplicated onto safety film and the nitrate film destroyed. Where it is considered necessary to keep nitrate film for record purposes, it shall be handled and stored in accordance with the precautions of NAVWEPS 10-1-764.

1804. ELECTRICAL EQUIPMENT

1. **General.** A great amount of photographic equipment is electrically operated. When working with or around such equipment the applicable precautions of Chapter 15 shall be followed.

2. **Inspection.** All electrical connections and wiring shall be regularly inspected for

1938

MT-PWHD-005548

0008 1230 REDACTED J-M 83

damage, frayed or broken insulation, and for possible short circuits.

3. **Turn Off.** All electrically operated equipment shall be turned off after use.

4. **Heating Equipment.** Some equipment, such as dry mounting presses, remains hot for some time after use. As soon as the heating elements in a press have been turned on, a plainly visible sign marked "Danger – Hot" shall be placed on the equipment and left there until after the machine has been turned off and has had a chance to cool.

5. **Wet Conditions.** Plugs, switches, or any parts of electrically operated machinery shall not be touched with wet hands or while standing in water or on a wet deck. The current shall be disconnected before attempting to salvage any electrical equipment that has become wet or has possibly come in contact with water while in use.

1805. FLASH EQUIPMENT

Harm to photographic personnel from photoflash equipment generally comes from the shattering of the glass bulb when a lamp is flashed or from a burn through personal contact with a hot bulb. When shipping, storing, handling, or using photoflash equipment personnel shall be guided by the applicable instructions and by the following precautionary measures.

1. **Shipment and Handling.**

a. **Case Shipments.** Whenever possible, flash lamp shipments shall be made in unbroken case lots. If it is not possible to make full case shipments, broken cases shall be repackaged in corrugated cardboard containers in a manner similar to that used by the manufacturers and carefully and thoroughly resealed.

b. **Labeling.** Before shipments are made shipping activities shall use red paint to stencil this warning on four sides of all packages containing photoflash lamps: *Caution – Do not transport this case of flash lamps if seal or case is broken.*

c. **Broken Case Lots.** Broken case lots of flash lamps carried in aircraft for the purpose of photography in flight shall be kept in spaces where they are visible at all times so that any fire that may result from lamp flashing can be seen and controlled immediately.

2. **Dangerous Areas.**

a. **Explosive Atmospheres.** The use of any type of flash equipment in an explosive atmosphere is extremely dangerous and must be avoided at all times. A lamp shall never be flashed unless the operator is certain that there is no danger from explosive elements (fumes, vapors, dust, etc.) in the atmosphere.

b. **Safety Permit.** If photographic reporting of accidents, disasters, etc., requires that flash equipment be used in locations where dangerous atmospheres may be present, written permission to use this equipment in such areas must be obtained from the officer or supervisor having cognizance over the area or location to be photographed.

3. **Photoflash Bulbs.**

a. **Handling.** Before bulbs are used they should be inspected for damage or deterioration of the plastic safety coating. Each bulb should be kept in its carton until ready to place it in the flash gun socket. Bulbs should not be carried loose in pockets or containers where objects can scratch or injure the outside coating.

b. **Contact Points.** The base of the flashbulb must never be moistened with the tip of the tongue. The acid used in the flux for the solder is very injurious to the tongue tissues and may cause infection. If the contact points are not clean and bright they should be slightly rubbed with emery cloth or fine sandpaper to insure proper electrical contact.

c. **Electrical Power.** Flashbulbs shall not be hooked up to any available power source unless instructions on the lamp carton authorize their use on 3 to 125 volts per couple.

d. **Shielding Bulbs.** When taking flash close-ups a lamp reflector shield shall always be used. If no shield is available the use of a clean white handkerchief over the flash gun reflector will provide emergency protection to

1939

MT-PWHD-005549

0008 123 REDACTED J-M 83

the individual being photographed. Flash close-ups shall never be taken at distances closer than five feet.

e. **Radar.** Personnel handling flashbulbs in the vicinity of radar equipment should keep flashbulbs in their cartons until just before using the bulbs. (See Chapter 15)

4. **Electronic Flash Equipment.** Electronic flash equipment is designed to work at a high potential, in most cases at least 2,000 volts, and even after discharge the condensers carry a heavy charge of electricity which must be depleted or bled off before any repair work can be attempted. There is the additional danger of sparking of the contact points in the power packs. The following precautions are to be followed explicitly when servicing and operating this equipment:

a. **Qualified Personnel.** Only qualified personnel shall service high voltage electronic flash equipment.

b. **Lamp Installation.** A unit shall not be charged for firing unless the flash lamp is installed and the complete assembly is ready for use.

c. **Lamp Removal.** If the assembly is not fired after it has been charged, the flash lamp shall not be removed for at least one hour.

d. **Hazardous Atmospheres.** This equipment shall never be operated where there is any possibility of the presence of explosive vapors, dusts or fumes.

e. **Power Cord.** The power cord from the power pack shall be disconnected before removing the lamp or touching the metal part of the lamp socket. Only manufacturer approved extension power cords shall be used to connect electronic flash heads to power packs.

f. **Batteries.** Before removing the batteries, the assembly shall be discharged and the charging switch changed from the charge position.

5. **Photoflash Bombs.** Photoflash bombs are loaded with a pyrotechnic material having a charge of high explosives, and when ignited they explode with extreme violence and intense heat.

a. **Handling.** Extreme care shall be exercised in handling these bombs because of their great sensitivity. No hammering or cutting should be done on the cases, and absolutely no work should be done on the bomb except by qualified ordnance personnel.

b. **Eye Protection.** Because of the brilliance of the flash (500 million candle power), personnel should be warned not to watch the explosion.

1806. CHEMICAL HAZARDS

1. **Familiarity With Precautions.** Prior to handling or working with photographic chemicals, personnel shall become thoroughly familiar with the detailed precautions for the chemicals involved. The applicable precautions of Chapters 17 and 20 pertaining to the handling of chemicals shall also be followed. A list of dangerous photographic chemicals and their antidotes is given in NAVWEPS 10-1-764. Other chemicals, however, may also be hazardous. General rules for emergency treatment given below shall be supplemented by the medical officer.

2. **Labels.** All chemical containers shall be legibly and completely labeled and special care shall be taken to be certain that poisons are so labeled.

3. **Storage.** All chemicals shall be stored in cool, dry, dark places. Separate storage areas shall be maintained for chemicals which react violently with each other to diminish the danger of fire or explosion. Shelves should have an edging strip to prevent chemical containers and equipment from extending over the edges or from being shoved off the shelves. Corrosive chemicals shall be kept in thick-walled glass containers protected by wooden frames or boxes. Containers having capacities of five gallons or more should be supported by a sturdy wooden or metal cradle pivoted or hinged for ease in pouring.

4. **Mixing Chemicals.** The following precautions shall be followed in mixing chemicals:

a. **Acid to Water.** Always add acid to water; never add water to acid. The acid

1940

MT-PWHD-005550

should be added slowly and with constant mixing.

b. Acid and Cyanide. Never mix an acid and a cyanide, as a lethal gas will be released.

c. Dissolving Alkalies. When dissolving strong alkalies such as sodium hydroxide or potassium hydroxide, use cool water.

d. Pyrex Containers. Use Pyrex glass containers when working with acids. Thick walled glass containers should never be used in mixing chemicals as such glass is more subject to breakage due to temperature changes.

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MT-PWHD-005551

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J-M 83



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0008 1851 REDACTED J-M 83

Chapter 19

COMMISSARY, MESSING, AND EXCHANGE FACILITIES

COMMISSARY AND MESSING

1901. GENERAL

1. **Responsibility of Personnel.** It is the responsibility of all personnel to know how to perform assigned duties in a safe manner. The correct way to do a job is the safe way. A person who is not certain as to his particular assignment, or the correct way to do it, should immediately ask his superior to inform him. He should become thoroughly familiar with the safety precautions applicable to his duties and should apply these precautions at all times if it is possible to do so.

2. **Unsafe Conditions.** Unsafe conditions, including damaged and defective equipment, are to be reported to the supervisor without delay. Repairs or replacements should be made as soon as possible.

3. **Clothing Hazards.** Certain kinds of clothing may be accident hazards. Thin or broken soles, high heels, and scarfs, for example, have caused serious, and even fatal accidents. Personnel should make sure that clothing is safe for a particular task. Open toe shoes and sandals are prohibited, and jewelry must be removed when a person is working near electricity and machinery or when he is handling heavy objects.

4. **Foot Protection.** Safety shoes or toe guards shall be worn by personnel engaged in handling heavy items such as case goods, beef sides, pork sides, etc.

5. **Lifting.** When carrying out lifting operations, these rules should be observed:

a. Keep back straight, bend knees, and let leg muscles do the work.

b. Ask for assistance when handling heavy or bulky objects.

c. Never attempt to lift anything when you are in an awkward position.

6. **Climbing.** Only a ladder set at a secure angle shall be used for climbing. Ladders are to be equipped with safety feet. Makeshifts shall never be used in place of ladders.

7. **Over-Reaching.** Stretching in order to reach objects may result in strains or falls. Therefore, over-reaching is to be avoided.

8. **Running.** Running, except in emergencies, is prohibited.

9. **Horseplay.** Personnel shall not indulge in horseplay or practical jokes. This kind of behavior often leads to injuries.

10. **First Aid.** Employees shall always arrange for first aid treatment to an injury, no matter how slight the injury may be. A scratch, if neglected or improperly attended, can lead to serious consequences.

11. **Safety and Operating Instructions.** Safety and operating instructions shall be posted adjacent to all equipment and shall be readily visible to the operator.

1902. NAVY EXCHANGE

1. **Stock Arrangement.** Merchandise should be displayed on counters and shelves in such a manner as to achieve the maximum safety for personnel and customers.

a. Stacking. Merchandise should be stacked so that there is no danger of its falling. The heaviest items should be placed on the bottom of the stack and the upper items overlapped pyramid fashion. Merchandise is not to protrude beyond the edge of counters or shelves.

b. Reach-Arms. Reach-arms are to be provided so that merchandise on the higher shelves is easily accessible.

1943

MT-PWHD-005553

0008 1235 REDACTED J-M 83

c. Cleaning Compounds. Store cleaning compounds and other caustic solutions in cool, dry areas on lower shelves only.

2. Waste Disposal. Empty boxes and cartons, excelsior, and other waste material is not to be accumulated behind counters, in the aisles, or elsewhere in the store. Waste should be disposed of promptly.

3. Equipment Handling. The following precautions shall be observed in the handling and maintenance of equipment:

a. Do not block the aisles with stools, display racks, stock baskets, stock trucks, or other equipment.

b. Keep shopping carts in good mechanical condition. Do not permit children to ride in shopping carts unless the carts are designed for this purpose.

c. Load stock trucks so that the merchandise will not topple. Push the trucks slowly and return empty trucks to the stockroom immediately.

d. When pin tickets are used for price marking do not leave the pin points exposed. Insert them into the tickets. Do not leave loose pin tickets on the counters.

e. Keep drawers and doors closed when they are not in use.

f. Arrange for repairs to be made as soon as possible on rough edges and splintered areas on equipment.

1903. STOCK ROOM

1. Storing Merchandise. When storing merchandise, the employee should observe the following safety rules:

a. Use shelving of sturdy construction.

b. Wherever possible arrange merchandise so that it is available without moving other merchandise. Always arrange merchandise so that articles likely to be needed first will be easily accessible.

c. Place the heaviest material on the bottom of stacks and overlap the upper material pyramid fashion.

d. Do not stack merchandise so high that it may fall. In the storeroom afloat, merchandise should be secured behind battens or lashed down if there is danger of its toppling.

e. Do not place merchandise on shelves, in bins, or elsewhere, in such a manner that it protrudes into the aisles.

f. Place flammable materials in lockers or in approved safety cans provided for them. Store the containers on lower shelves only.

2. Ventilation. The stockroom should be properly ventilated if possible. When an employee enters a closed stockroom which has not been properly ventilated, he should arrange for another person to stand outside in case of emergency. The door should remain open. Aboard ship a damage controlman should enter an improperly ventilated storeroom before other personnel are allowed to enter.

3. Securing a Stockroom. It must be determined that everyone is out of a stockroom before it is secured.

4. Repairs. Rough areas, splintered edges, and other such hazardous conditions should be repaired as soon as possible.

5. Smoking. Smoking in stockrooms is prohibited.

1904. RECEIVING ROOM

1. Equipment. The following rules apply to the type and use of equipment in a receiving room:

a. Trucks.

(1) Use hand-trucks or flat-truck for moving heavy cases.

(2) Do not attempt to load merchandise on two-wheel hand-trucks without assistance.

(3) Do not overload hand-trucks.

(4) Never push hand-trucks rapidly or carelessly.

(5) Park empty trucks in an area designated for this purpose. Two-wheel hand-trucks should be parked in an upright position.

b. Gloves. Gloves are to be worn when an employee is handling wooden crates or performing other duties in which there is danger of injury to his hands.

c. Goggles. Safety goggles must be worn when cases are being opened for pro-

1944

MT-PWHD-005554

0008 1236 REDACTED J-M 83

tection against flying splinters and flying ends of bailing wire or metal strapping.

d. Tools. Cartons and cases are to be opened with appropriate tools.

(1) Cartons which are not to be used again should be opened with a safety carton opener.

(2) Cartons which are to be used again should be opened with a spatula-shaped instrument.

(3) Cases should be opened with any of the following tools necessary: pinch bars, nail pullers, wire cutters, and steel strapping cutters. Hammers, lather's hatchet, axe, etc., should not be used for opening wood boxes or crates.

2. Unpacking Merchandise. Merchandise shall be unpacked in accordance with the following regulations:

a. Wear gloves when unpacking merchandise.

b. Unpack merchandise as soon as possible after its receipt.

c. Remove protruding nails, staples, and wire from boxes and barrels before unpacking their contents.

d. Beware of broken glass when reaching into packing cases in which glass items have been shipped.

e. Do not pick up broken glass with bare hands.

f. Stack unpacked merchandise in a safe location and in safe piles to prevent its toppling or being trampled.

g. Properly dispose of packing material immediately. Nails, pieces of wire, metal stripping, and other such packing materials may cause injury if dropped on the floor.

h. Stow empty packing cases in a safe manner in an area designated for this purpose.

1905. COMMISSARY

Precautions set forth in the articles on the store, storeroom, and receiving room shall be observed in the commissary when applicable. In addition, other safety precautions are to be followed.

1. Coffee Grinder

a. Place the coffee grinder where it will not be accessible to children.

b. Disconnect the grinder before cleaning it.

2. Dairy Department. Check bottled goods for chips and cracks. Do not sell damaged merchandise.

1906. BUTCHER SHOP

1. General. The following general precautions are to be observed in the butcher shop.

a. Crowding And Jostling. Personnel must be careful not to crowd or jostle one another. Crowding and jostling are particularly dangerous in the presence of the cutting instruments and sharp pointed hooks which are found in a butcher shop.

b. Meat Trimmings. In addition to observing general housekeeping precautions, personnel in the butcher shop should be especially careful not to let meat trimmings lie about on the floor. They not only attract flies and insects but create extremely dangerous slipping hazards.

2. Cutting and Slicing Operations. Butchers must pay particularly close attention to their work when using cutters or slicing equipment. The slightest miscalculation or a minor slip can lead to a serious injury.

3. Hand-Operated Tools. The following precautions with reference to hand-operated tools are to be observed:

a. Maintain a complete set of tools at each block so as to avoid unnecessary injuries which may be suffered from carrying the tools about.

b. Keep the handles of tools clean and dry. Greasy or wet handles may cause accidents.

c. Grip instruments firmly.

d. Be sure your fingers are below the guard when using a sharpening steel.

e. Use only sharp knives. Dull knives are greater accident hazards than sharp knives during cutting operations.

f. Never hold a knife in your hand when carrying any other object.

1945

MT-PWHD-005555

0008 1237 REDACTED J-M 83

g. Be careful not to lay a piece of meat on a knife. The meat may conceal the cutting edge.

h. Do not place knives in the wash water until ready to wash them. Lay them in plain view beside the sink.

i. When using a cleaver, keep your free hand as far from the path of the cleaver as is necessary to assure safety.

j. Use a hand meat hook when lifting or boning meat.

k. Use a scoop to handle shrimp.

l. Keep the surfaces of meat blocks level.

m. Store tools in their proper places.

4. **Electrically Operated Equipment.** Precautions pertaining to electrically operated equipment are set forth in Chapter 15. In addition to those, the following specific precautions, to be observed when using electrically powered machines shall be permanently posted adjacent to the machine.

a. Power Meat Saw

(1) Adjust the blade before the machine is started.

(2) Do not twist the blade while operating the machine.

(3) Never leave the machine running when it is not in use. Turn it off immediately upon completion of the cutting operation.

(4) Disconnect the machine before cleaning it.

b. Electric Meat Grinder

(1) Adjust the cutter before the power is turned on.

(2) Never feed the machine entirely by hand; use a pusher-stick.

(3) Do not attempt to remove anything from the machine while the machine is running.

(4) Disconnect the machine before cleaning it.

c. Cube Steak Machine

(1) Do not permit your hand to get too near the food slot when feeding meat into the machine.

(2) Disconnect the machine before cleaning it.

d. Slicing Machine

(1) Adjust the blade for size of cut before turning on the power.

(2) Make sure all guards are secured before operating the machine. Never use the slicer when the blade guard is off.

(3) Do not operate the machine with wet hands.

(4) Keep your hands away from the blade when the machine is running.

(5) Never put your hands under the guard on the slicer.

(6) Disconnect the machine before cleaning it.

(7) Use a cloth on a stick to clean the blade. Wipe from the center of the blade toward the cutting edge.

5. **Other Equipment**

a. "Walk-In" Boxes

(1) Do not enter freezing rooms without proper clothing.

(2) The signal light which signifies whether anyone is in the box shall be checked daily to determine that it is in working order.

(3) Report immediately any evidence of escaping refrigerator gas.

(4) Do not carry objects which are large enough to obscure your view.

(5) Be careful not to snag yourself on meat hooks.

(6) Keep the floor dry and clean. Remove blood drippings promptly.

(7) *Learn the location and operation of escape hardware on refrigerator doors.*

b. Display Cases

(1) Maintain proper temperature in refrigerated display cases.

(2) Report immediately leaks or loose connections.

(3) Be sure that electrical refrigeration compressors are grounded.

1907. GALLEY

1. **General**

a. **Marking of Doors.** Mark double swinging doors "IN" and "OUT". Use the correct door and pass through slowly.

1943

MT-PWHD-005556

0008 12 REDACTED

b. Handling of Hot Foods And Liquids

(1) Do not allow the handles of cooking utensils to extend beyond the edge of the range. They can be bumped and serious burns to personnel result from spilled food or liquid.

(2) Before removing foods from hot ranges and ovens be sure there is a clear place on which to set them.

(3) Use only the proper implements, such as pot holders and tongs, for handling hot foods.

(4) Carry hot liquids in covered containers with the covers securely in place.

(5) Do not bump into anyone when hot food is being carried.

(6) Immediately mop up grease which is spilled on the floor. Greasy floors are doubly hazardous. They can cause fires as well as falls.

c. Proper Use And Care Of Utensils

(1) Use only the proper implements for opening cans and other containers. Meat cleavers shall never be used to open cans or cases.

(2) Hold knives firmly. This cannot be done if the handles are wet or greasy.

(3) Knives are to be kept in a drawer designated for this purpose only. The handles should be kept to the front and the cutting edges should face in one direction.

(4) Keep utensils and other implements in their proper places when they are not in use.

2. Equipment

a. Operation. Inexperienced personnel shall not be permitted to operate galley equipment until thoroughly indoctrinated.

b. Power Source. Power for all equipment shall be disconnected at the distribution panel and the panel locked whenever galley is secured.

c. Ranges and Ovens

(1) Be sure that jets on gas ranges and ovens are fully lit when in use and are turned off when not in use.

(2) Open the dampers on oil-fired or gas-fired ranges when these ranges are not in use. Be sure dampers are opened before lighting off.

(3) Ranges and ovens should be equipped with automatic controls and door interlocks whenever feasible. All stacks shall be equipped with an automatic fire extinguishing system.

(4) Do not allow grease to collect anywhere on ranges or ovens. Greasy ranges and ovens are serious fire hazards. Dirty ranges and ovens can partly be avoided by using utensils of proper size, by regulating the flame to prevent boiling over, and by careful handling of utensils to prevent spilling.

(5) In case of fire in a range or oven immediately call the Fire Department. Then use available portable carbon dioxide (CO_2) or dry chemical extinguishers on the blaze.

(6) Do not attempt to clean ranges and ovens while they are hot.

(7) Never clean electrically operated ranges and ovens with water – severe shock may be suffered.

(8) Lights over ranges, ovens, and cooking urns shall be enclosed in vaporproof globes and guards.

d. Vegetable Chopper

(1) Make certain that the bowl is seated properly and that the chopping blade and guard are secure before starting the machine.

(2) Do not attempt to remove produce which has lodged between the blade and the housing until the machine is turned off and the blade has stopped revolving.

(3) Vegetable choppers shall be equipped with an interlock which disengages the electric current when guard is removed.

e. Potato Peeler

(1) Never operate the peeler unless water has been properly applied.

(2) Do not put your hand in the machine while it is running.

(3) Do not adjust the peeler unless the power has been shut off.

f. Food Cutter

(1) Be sure that the knives are in proper position and the guard is securely in place before starting the machine.

MT-PWHD-005557

0008 1239
REDACTED
J-M 83

(2) Do not put your hands in the bowl while the knives are revolving.

g. **Food Chopper**

(1) Feed the food chopper with a wooden push stick; never feed it with your hands.

(2) Keep the same knife and plate together, as they wear to fit each other. Improperly fitted knives can break and fly off the machine.

h. **Food Mixing Bowl**

(1) Properly attach the mixing bowl before starting the machine.

(2) Keep your hands away from the mixing chamber while the machine is in operation.

i. **Dough Mixer**

(1) Be sure the mixing tub and the wire whip are seated properly before starting the machine.

(2) Do not put your hands in the mixing tub while the machine is in operation.

j. **Steam-Jacketed Kettle**

(1) Determine that the safety valve is in proper working order before using the kettle.

(2) Do not tamper with the safety valve or tie it closed. It is there to prevent the kettle from exploding. Safety valves shall be tested periodically to make sure that it is working at the set pressure.

k. **Pressure Cooker**

(1) Be sure that the safety devices are in proper working order before using the cooker.

(2) See that the cover is securely in place before turning on the heat.

l. **Deep Fat Fryer**

(1) The temperatures of the fat shall be thermostatically controlled, and under no conditions shall the fat be heated over 400°F.

(2) Heating elements, thermostats, electrical connectors, and switches shall be cleaned and adjusted monthly, or more frequently if needed, by a qualified electrician.

(3) The electrical insulation shall be tested monthly for insulation resistance.

(4) Before using a fry kettle, be sure the drain is closed tightly. Fill kettle only to the level recommended by the manufacturer.

(5) Keep the equipment, especially the electrical fixtures, clean at all times.

(6) Kettles should be kept covered when not in use.

(7) A baffle or shield shall be set up between fry kettle and any adjacent range or grill.

m. **Grill**

(1) Do not allow grease to accumulate on the cooking area of the grill.

(2) Use only the tools provided for turning food and removing it from the grill.

(3) Maintain proper exhaust ventilation. The proper ventilation cannot be maintained if grease is permitted to collect in the exhaust. Clean the exhaust semimonthly or oftener.

(4) Do not permit excessive grease to accumulate in the grease disposal trough.

(5) Be sure that burners are fully lit when in use and are turned off when not in use.

3. **Food Preparation.** Precautions relating to food preparation are set forth in NAVMED P-5010.

1908. MESS

1. **Use and Care of Equipment**

a. **Steam Table**

(1) Use the proper implements, such as pot holders and tongs, for handling the containers.

(2) Tilt containers away from you when inserting them into the wells.

(3) Cover unused openings to prevent scalding.

b. **Coffee Urn**

(1) Keep hot water to the safe level indicated by the gauge on the urn.

(2) Be sure that the safety valve is in proper working condition. Safety valves should be tested periodically to determine they are working at the set pressure.

(3) All automatic coffee makers shall be equipped with thermostatic controls.

c. **Fountain.** Use duck-boards between the fountain and the back bar area if it is possible to do so.

1943

MT-PWHD-005558

0008 12-4C REDACTED J-M 83

d. Ice Cream Freezer Unit With Cabinet

(1) Never run hot water into any cold freezer.

(2) Lock the switch in the "off" position before cleaning the mixing drum.

e. Vending Machines

(1) Electric vending machines must be grounded.

(2) Keep vending machines clean.

(3) Report defective machines promptly.

(4) Dispose of broken bottles immediately. Empty bottles should be placed in nearby cases provided for that purpose.

(5) Use a hand-truck or other wheeled vehicle to lessen exertion and strain when transporting cases of bottles.

(6) Stack cases in such a manner as to avoid toppling and tripping hazards.

(7) The areas around vending machines should be policed frequently to make certain these precautions are being observed.

1909. SCULLERY

1. Dishes

a. Do not stack glassware and dishes so high that there is danger of their toppling.

b. Never pick up broken glassware and dishes with bare hands.

c. Immediately place broken pieces in containers provided for that purpose.

d. Do not load silverware baskets too heavily for safe handling.

e. Do not expose hands to dishwashing solution. Rubber gloves should be worn when strong alkaline dishwashing compounds are used.

2. Equipment

a. Pre-Rinsing Machine

(1) Keep hands outside the hopper while the machine is in operation.

(2) Watch for sharp edges which may occur on the strainer, and make the necessary repairs.

b. Dishwashing Machine

(1) Be sure vent supply is in proper working condition.

(2) See that thermostatic controls are functioning properly.

(3) Heavy ship motion may cause scalding rinse water to surge from machine. During rough weather, exercise particular care in operation of machine. If necessary, secure and drain machine.

(4) Never allow the minimum temperature of the rinse water to fall below 180°F.

(5) Keep the side door closed while the machine is operating.

(6) Do not place your hands in the machine while the steam is on.

(7) Exercise care in feeding the machine to prevent hands from getting caught in the conveyor.

1910. DUMB-WAITERS

1. The equipment shall be tested at least annually.

2. All safety control devices shall be so located as to prevent tampering and manipulation while any dumb-waiter door is open.

3. Operating instructions shall be posted at control stations. Instructions shall include all necessary safety precautions and load limitations of equipment.

4. Dumb-waiters shall be taken out of service whenever safety devices are inoperative and are not to be put into service until repairs have been made.

5. There shall be suitable means of communication between all operating stations.

EXCHANGE FACILITIES

1915. COBBLER SHOP

1. General Care

a. Keep floors and passageways free of supplies and scraps at all times.

b. Store tools in their proper places when they are not in use.

c. Use caution when handling rubber cement. It is highly flammable. Only the minimum amount required should be kept in the shop. Containers are to be kept covered.

d. Suitable seats shall be provided for employees who are engaged in work that

MT-PWHD-005559

0008 34 REDACTED J-M 83

can be performed while seated.

e. All containers used to dispense flammable or toxic materials shall be labeled in accordance with Chapter 20.

2. Machinery

a. Rules Applicable To All Machinery

(1) Inspect machinery each morning before beginning operations to determine whether it is in satisfactory working condition.

(2) Permit only assigned maintenance personnel to repair machinery.

(3) Never operate equipment at a speed in excess of that prescribed by the manufacturer.

(4) Revolving shafts and couplings, pulleys, belts, gears, sprockets, chains, and friction drives should be encased or protected by guards.

b. Stitcher

(1) When starting the stitcher, push the wheel with the open palm. Never grasp the wheel.

(2) Stand to the right of the shoe guide.

(3) Face must be kept at a safe distance from the work table and away from the presser-foot lever.

(4) Fingers must be kept clear of the gears, presser-foot, and flywheel while the machine is in operation.

(5) When sewing, do not grasp the vamp in order to pull the upper away from the welt, as the awl may pierce the fingers. If it is necessary to pull the upper away from the welt, stop the machine. Before starting the machine again, be sure fingers are not too close to the welt.

(6) When threading the machine, or when making adjustments and repairs, shut off the motor and turn the wheel by hand.

c. Finishing Machine

(1) Be sure cutters are tightly secured before the machine is started.

(2) Make certain the exhaust is turned on before trimming operations are begun.

(3) Do not hold fingers too close to the part which is being trimmed or sanded.

(4) Wear protective goggles for trimming and sanding operations.

(5) Hold the shoe firmly during trimming and sanding operations.

(6) Shut off the motor before changing wheels, sandpaper, and emery cloths. Before the power is turned on again, be sure the wheels are locked in place.

(7) Clean dust collectors daily. The suction of collectors should be strong enough to eliminate flying dust particles which might get into the eyes.

(8) Sleeves should be rolled up to the elbow so that they will not be caught in the machinery.

d. Rough Rounder

(1) Check safety guards on cutting knives before using the machine to see that they are secured in the proper position.

(2) Never make adjustments or repairs when the switch is in the "on" position.

e. Sanders

(1) Keep hoods down on sanders and heel resting canes at all times.

(2) Be sure that sanding wheels are securely locked after replacing sandpaper.

1916. TAILOR SHOP

1. General Care

a. Store flammable solvents in approved safety vessels. Not more than one gallon of solvent shall be open at one time.

b. Keep areas used for the storage of tailoring work in sanitary condition.

2. Machines

a. Pressing Machine

(1) Do not allow anyone to stand near enough to the press to receive steam burns.

(2) Do not place hands on the buck while the steam is being applied or while the head is being lowered.

(3) Avoid the application of too much steam. Pressure should be kept to 60-65 pounds when the machine is in operation.

(4) Never bring the head down on the buck while trying to smooth out garments.

(5) Release the head when the press is not in use.

MT-PWHD-005560

0008 1242 REDACTED J-M 83

(6) Be sure that no one is standing at either end of the press when the head is to be released.

(7) Know the location of the main steam valves. In an emergency, these valves are to be closed.

b. Puff Iron

(1) Hands must be kept off the puff iron while the steam is being applied.

(2) Hold clothing being ironed in such a manner that hands will be at least 6 inches from the iron.

c. Sewing Machine

(1) Safety-type sewing tables with no exposed shafting and pulleys are recommended. Where it is impossible to enclose shafting, belting, and pulleys, skirt boards fastened under the table will usually protect operator's feet and legs from striking moving parts. All main drive belts, gears, and pulleys should be well guarded.

(2) The sewing machine should be equipped with a permanent guard so that the operator's fingers cannot pass under the needle. The machine should not be used at any time unless the guard is in place.

(3) Never touch the shuttle-carrier or the flywheel while the machine is in operation.

d. Rotary And Vertical Cloth Cutters

(1) The revolving or reciprocating blades should be equipped with an adjustable guard in front of the cutting edge. This guard should always be set so that there is a minimum of the cutting edge exposed during normal operation.

(2) The power should always be disconnected when the machines are not in use.

1917. DRY CLEANING SHOP

For detailed information as to precautionary measures to be used in the dry cleaning shop study the National Fire Protection Association (NFPA) pamphlet No. 32, *Dry Cleaning Plants*, which is the standard and approved guide on this subject. This pamphlet is available from NFPA Headquarters, 60 Batterymarch St., Boston, Massachusetts, 02110. Observe also the following precautions:

1. Ventilation and Humidity

a. Inspection Of Ventilating System. Before any cleaning operations are performed inspect the ventilating system to determine that it is operating properly. A complete change of air should be provided once every 6 minutes.

b. Vapor Concentration. In a dry cleaning shop which uses synthetic solvent, adequate ventilation must be provided to prevent danger from the toxic and flammable nature of solvent vapors.

c. Insuring Proper Humidity. The psychrometer shall be read at least hourly to insure that the proper humidity (not less than 60%) is maintained.

2. Protection to Personnel

a. Cleaning solutions are not to be used for personal cleanliness.

b. Food must not be taken into rooms where cleaning machines or tumblers are located.

c. Sleeping in the dry cleaning shop is prohibited.

d. Sprinkling of clothes by mouth is prohibited.

e. A first aid kit shall be supplied to the dry cleaning shop. At least one person in the shop should know how to administer first aid.

3. General Inspection. Steam and other fire extinguishing systems, including valves and piping, should be inspected monthly. Steam lines should be tested annually.

4. Equipment

a. General Care

(1) Only approved equipment with explosion-proof motors and other fire-protection features shall be used. Fail-safe and interlocking safety devices should be installed on the equipment wherever possible.

(2) Grounding systems shall be inspected and tested once a month and necessary repairs made immediately.

(3) Gauge glasses and sight glasses are to be protected against mechanical injury. They should be inspected daily for damage. The breaking of these glasses permits flammable liquids to escape.

MT-PWHD-005561

0008 1243 REDACTED J-M 83

(4) Gauge shut-off valves shall be maintained in full operative condition at all times.

(5) Washers, extractors, treating tanks, clarifiers, separators, and stills should be liquid-tight. When splashing or leaking of solvent from those machines is discovered, repairs should be made immediately.

(6) Washing machines, extractors, scrubbing tables, and scrubbing tubs that utilize flammable liquids shall have return pipe lines not less than 1½ inches in diameter, provided with a liquid seal trap, and arranged so that the flammable liquids can be returned by gravity to the underground tanks.

(7) Use automatic means for closing covers of washing machines and drying tumblers.

(8) Scouring or brushing tables should have liquid-tight tops with curbs at least one inch high on all sides.

(9) Lint and refuse are to be removed from traps and placed in approved waste cans. Waste materials should be removed from the premises at the close of business each day.

b. Electrical Equipment

(1) Light fixtures, wiring, motors, and all other electrical accessories shall comply with Class I, Group D, hazardous locations, as defined in the National Electrical Code.

(2) Safeguard electrical equipment. Static electricity is a special hazard because of the nature of the machines used in a dry cleaning shop. NFPA Pamphlet No. 77M, *Static Electricity*, shall be used as a guide for preventing accumulation of static electricity.

c. Washing Machine

(1) Before using the washing machine, check the interlocks to the cylinder to be sure that they are working properly. Be sure the cylinder is in a locked position during loading and unloading.

(2) Wherever feasible, the outer shell doors shall have automatic controls so that the doors will close in case of fire or other emergency.

(3) The outer shell doors should be splash-tight.

(4) Dry cleaning machines should be kept closed except when they are being loaded or unloaded.

d. Extractor. Before using the extractor, inspect the interlocking devices. These must be in proper working order to prevent the cover from being opened while the basket is in motion and to prevent the basket from turning while the top is open.

e. Conveyor

(1) The conveyor should be constructed in such a manner as to prevent flammable liquids from dripping on the floor when goods are being moved from washing machine to extractor.

(2) A portable conveyor should be equipped with wooden or fiber-rimmed wheels or wooden shoes to prevent mechanical or static sparks.

(3) Portable containers used as conveyors for the transportation of goods from the washing machines to the extractors should be kept free of flammable liquids.

f. Tumbler

(1) Interlocks should be inspected before tumblers are used to insure that the cylinders will remain locked when the machines are being loaded or unloaded.

(2) Goods are to be removed from the drying tumbler after the drying process is finished to prevent spontaneous ignition or combustion.

(3) A drying tumbler should be vented to the outer air to prevent the accumulation of explosive vapors.

g. Drying Cabinet

(1) Drying cabinets, except for those with wooden interiors which are already in use, should be constructed of noncombustible material. Existing cabinets with wooden interiors should be lined with insulating material not less than ¼ inch thick.

(2) Racks used in drying cabinets should be noncombustible.

(3) Cabinets should be ventilated to the outer air to prevent the accumulation of explosive vapors. Where heat is used for

MT-PWHD-005562

0008 1344 REDACTED

JM 83

drying, flammable vapors may be given off even with a high flash solvent.

5. Cleaning Operation

a. Types of Cleaners. The following information should be used as a basis for determining the safest cleaner to use under certain specified conditions. For further details see NFPA Pamphlet No. 32. (See 1917)

(1) Naphtha has a volatility similar to that of gasoline. Use instead Stoddard Solvents (especially refined petroleum products) or other solvents with a flash point over 100°F to reduce hazards of gasoline and naphtha.

(2) Use a solvent of the rating which is prescribed for the dry cleaning system being used.

b. General Precautions

(1) All clothes shall be thoroughly searched before cleaning and all foreign materials especially matches and metallic substances, removed.

(2) No drying operation before washing shall be permitted unless articles so dried are properly humidified before removal to washing machines.

(3) Check all liquids used. Even in plants using nonflammable solvents spotting operations are often done with flammable solvents. In case of doubt about any cleaning fluids, check the flash point.

(4) Volatile flammable liquids, except those contained in a still, purifier, supply tank for clarifier, or an underwriter's approved container, shall not be placed above ground level during cleaning operations.

(5) Volatile flammable liquids shall not be settled in open or unprotected vessels or tanks.

(6) Flammable liquids or solvents are not to be used for cleaning floors.

(7) Cleaning solution that is spilled should be mopped up immediately.

(8) Dry cleaning by immersion and agitation in closed machines shall be carried on only in machines that have been approved for this type of cleaning.

(9) Dry cleaning by immersion and agitation in open vessels is prohibited. When articles cannot be washed in the customary machines, they may be cleaned on scouring or brushing tables, or in approved scrubbing tubs. In such instances, not more than 3 gallons of solvent are to be used at one time.

c. Spotting

(1) Spotting is a special hazard because of the low flash point of most liquids sold for spotting. Too much friction in rubbing spots can cause ignition of the material.

(2) Avoid inhaling vapors when getting close to material during spotting operation.

(3) Not more than one quart of flammable solvent should be used at one time during spotting operations. The solvent shall be stored in and applied from an approved safety can.

(4) Containers used to dispense flammable or toxic solvents shall be labeled in accordance with Chapter 20.

d. Disposal of Liquids. Cleaning fluids are ordinarily distilled for reuse, or, when necessary, are disposed of completely. The following rules for distillation and disposal should be followed. For further details see NFPA Pamphlet No. 32 and the current edition of The National Fire Code, Vol. 1.

(1) Flammable liquids shall not be discharged into drains or sewers. When disposal presents an accident, health, or fire hazard, the safety engineer, fire chief, district fire protection engineer, or medical officer shall be consulted for proper disposal method.

(2) Stills are not to be used for storage purposes.

(3) Distilling apparatus should be drained of solvents at the close of business each day.

(4) Stills, condensers, and treating tanks shall be of substantial construction, mounted on substantial fire resistive foundation or framework, and shall be of a type which will not expose the liquid during any part of the process or reclamation. Steam or hot water *only* shall be used to secure the necessary temperature. Stills and condensers shall be liquid and gas tight.

MT-PWHD-005563

0008 1245 REDACTED J-M 83

(5) Each still shall be equipped with a vacuum and pressure relief valve arranged to discharge outside the building. Relief valve shall not be less than 1½ inches and set not over 5 pounds. When a shut-off valve is installed between still and condenser the relief valve shall be located on the still side of shut-off valve. A check valve shall be installed in the steam line between the boiler and the still.

(6) Each still should be provided with an automatic heat actuated emergency drain connection of ample capacity to discharge entire contents to underground storage tanks within a period of five minutes.

(7) Where not practical nor desirable to distill cleaning fluids for reuse, the storage, handling, or disposal of same shall be in accordance with the standard Navy Department practice for handling or disposing of contaminated volatile liquids.

6. Fire Protection. Since fire hazards in a dry cleaning shop are particularly great, constant attention to all precautions is essential.

a. Equipment. The following equipment shall be used to insure the highest possible degree of safety:

(1) An asbestos blanket not less than 7 x 7 feet and a boat hook with a handle at least 6 feet long shall be provided for each dry cleaning room and shall be kept on a convenient rack at the principal entrance.

(2) Approved extinguishing devices of a type suitable for use on oil fires (class B) shall be provided for every room or area where flammable liquids are stored or used. In no case shall there be less than one extinguisher at each entrance of every room or area where liquids are stored or used.

b. General Precautions

(1) Fire fighting equipment shall be inspected regularly to insure its immediate usability in case of emergency.

(2) Smoking is strictly prohibited in dry cleaning rooms. "No Smoking" signs shall be conspicuously posted.

7. Fire Fighting. In case of fire, call the Fire Department immediately. Employees should then proceed to operate *only* as an auxiliary fire brigade by assisting the regular fire fighters.

a. Ventilating Systems. Shut down the ventilating system immediately in case of fire. Interlocks should be provided to accomplish this from automatic extinguishing systems.

b. Use of Automatic Systems. Use the automatic extinguishing system. *Do not stay in the room for purposes of manual fire fighting unless the fire is confined to a small portion of the room.* Flammable liquids cause too much heat and smoke to allow manual fire fighting.

c. Principal Methods of Extinguishing

(1) Automatic covers will smother fire when they are closed automatically by operation of a fusible link. They are suitable for any size tank but not where objects being dipped, or conveyors, may prevent tight closing.

(2) Carbon dioxide extinguishers are effective for gasoline fires in small tanks. They are also satisfactory for use on alcohol fires.

(3) Carbon dioxide automatic flooding systems are acceptable for extinguishing fires in any flammable liquid.

(4) A dry chemical extinguisher is effective for class B and class C fires and for alcohol fires.

(5) A foam extinguisher is effective for class B fires. Special types of foam are needed for alcohol fires.

(6) Automatic foam systems provide excellent protection against petroleum fires if properly designed. Special alcohol-resistant type foam must be used for alcohol fires.

(7) Water spray (fog) extinguishes fires in fuel oil, linseed oil, lubricating oil and other heavy liquids. Water spray does not readily extinguish fires from kerosene, gasoline, and other light liquids but does absorb heat and help prevent spread of the fire to other combustibles.

(8) Automatic sprinklers are not effective extinguishers on petroleum fires but do absorb heat and keep the surroundings

MT-PWHD-005564

0008 1246 REDACTED J-M 83

cool until the liquid fire has been extinguished by other means.

(9) Solid hose streams are good for keeping tanks cool or for washing burning spills on the floor away from danger points. A hose stream serves only to spread fire when directed into open tanks of gasoline and similar liquids.

d. After-Fire Care. Cool all embers and hot metal surfaces to erase the danger of reignition.

1918. BARBER SHOP

1. General Rules

a. Keep the barber shop clean.

b. Observe personal cleanliness. Barbers shall be examined by the medical officer at regular intervals.

c. Do not perform barber services on persons showing symptoms of diseases of the scalp or skin unless the medical officer has directed in writing that these services be performed.

d. Do not remove ingrown hairs or blackheads for customers.

2. Use and Care of Equipment

a. Use extreme caution in handling such potentially dangerous equipment as razors and scissors. Avoid jostling.

b. Sterilize such equipment as razors, scissors, clippers, combs, and brushes before using.

c. In shops doing a large amount of business alternate clippers should be used so that the clippers will not become overheated.

d. Keep sterilizing cabinets in the proper sterilizing condition in accordance with instructions from the medical officer.

1919. BEAUTY SHOP

1. General Care

a. Keep the beauty shop clean.

b. Observe personal cleanliness. Beauty shop operators shall be examined by the medical officer at regular intervals.

c. Do not perform beauty shop services on persons showing symptoms of diseases of the scalp or skin unless the medical officer has directed in writing that these services be performed.

d. Do not remove ingrown hairs or blackheads for customers.

2. Equipment

a. Hand-Operated Tools

(1) Use extreme caution in handling such potentially dangerous equipment as razors, and scissors. Do not carry scissors, razors, and other such equipment in your pockets. Avoid jostling.

(2) Sterilize equipment such as razors, scissors, clippers, combs, and brushes before using.

(3) Keep sterilizing cabinets in the proper sterilizing condition in accordance with instructions from the medical officer.

(4) Always follow strictly the manufacturer's instructions for use of equipment when giving a machineless wave.

(5) When giving machineless waves use new aluminum foil pads and absorbents for each customer.

b. Permanent Wave Machines

(1) Do not leave the customer during the time the machine is being heated. The thermostat may fail to work automatically and cause severe burns.

(2) Check time-clock to determine whether it is working properly.

(3) As a fire prevention measure, do not use flammable covers on permanent wave units or dryers when these machines are not in use.

(4) Supplies used for a permanent wave machine must be those which are specifically designed for that machine.

1920. WATCH REPAIR SHOP

The following precautions to insure personal protection are to be observed in the watch repair shop:

1. Exercise care to prevent cutting hands on broken lenses and crystals.

2. Wear goggles when using a crystal grinding machine or lathe.

1921. LAUNDRY

1. Care of Laundry Room

a. Store acids, bleaches, and other strong solutions in cool, dry areas on lower shelves only.

MT-PWHD-005565

0008 1247

REDACTED
J-M 83

b. Materials or bundles shall not be piled on shelves in such a way that they protrude into passageways or are likely to fall.

c. Keep the floor drains unclogged.

d. Sweep suds and water down the drains frequently.

e. Sleeping in the laundry room is prohibited.

2. Personal Protection

a. Wear proper personal protective equipment such as goggles, rubber gloves, and rubber aprons when handling or using acids, bleaches, solvents, boiler compounds, and caustic solutions.

b. Employees shall not wear neckties or loose-fitting clothing, and female employees shall wear a protective covering over their hair.

c. Wear goggles when using an air hose to blow dirt from pockets and cuffs.

d. Do not attempt to pour acid from a carboy without use of a suitable carboy dispenser or rocker.

e. If caustic solutions are spilled on the body, thoroughly wash the affected parts in accordance with posted instructions. Report to the dispensary for examination and for further treatment.

3. Preparing Clothes for the Laundry

a. When using a truck for heavy bundles of clothing the load should be placed so that the pusher has a clear view ahead.

b. Dump laundry out of bags. Do not reach into the bags to pull the laundry out.

c. Be sure that the pockets of clothing to be laundered are empty.

d. Keep safety pins closed.

4. General Safety Rules

a. Nails projecting from soap or washing powder boxes or barrels shall be removed promptly when the package is first opened.

b. All crating and packing materials shall be disposed of at the time the package is opened.

c. Storage bins, shelving, and timbers shall be watched for ragged edges and splinters, and such defects shall be corrected immediately.

d. Barrels, boxes, and containers shall be properly marked as to contents and shall be stored so that the label can be seen without moving the container.

e. All machines and safety devices shall be checked daily for defects, and any necessary repairs shall be made promptly.

5. Equipment

a. Washer

(1) Driving mechanisms of washers should be fully encased by metal guards.

(2) Be sure the power is off before loading or unloading the machine.

(3) Avoid straining muscles when unloading the washer. Do not attempt to unload too much at one time.

(4) Machines should be provided with approved means for holding the shell doors open.

(5) Safety interlocks are to be provided to prevent the cylinder from operating when the machine is being loaded or unloaded, except when using the "inching" device.

(6) The brakes should be capable of stopping and holding the cylinder against rotation when the current is shut off.

(7) Inspect cylinder doors daily to determine that they are in proper working condition.

(8) Cylinder doors should be fitted and wedged in such a manner as to prevent movement when they are locked.

(9) Swing the apron out of the way before closing cylinder doors.

(10) Latch the cylinder doors before starting the machine. The latch handles should be placed securely in their wells.

(11) Do not turn on the steam until the doors are closed and the safety switch is on. Never assume that the safety switch is on; be sure.

(12) Do not open the shell doors while the machine is in operation.

(13) Do not put bleach in the water when the steam is on.

(14) Do not allow the temperature of the wash water to rise above 160°F.

(15) The tension of the belts on the wood washers should be tested frequently to

MT-PWHD-005566

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008 1248
J-M 83

see that the belts are not slipping. Test only when the machine is inoperative.

(16) Never shift belts by hand.

(17) Try to prevent rust remover from coming into contact with your skin. Thoroughly rinse fabrics which have been treated with rust remover.

(18) Splash guards should be installed on the floor drains to prevent the occurrence of slipping hazards.

(19) The washing machine should be provided with a drain which carries away suds and water without wetting the floor.

b. Extractor

(1) Check safety devices before operating the machine. If the mentioned safety devices are inoperative, *secure the extractor and do not use until it is repaired.*

(2) Never operate the extractor with the cover open. This has often resulted in the death of the operator.

(3) Do not exceed the rated capacity when loading the machine. Overloading is injurious to the machine as well as an accident hazard to personnel.

(4) Distribute the load evenly. If the machine vibrates excessively, or the basket wobbles, stop the machine and redistribute the load.

(5) Never overload the machine.

(6) Keep away from the extractor while it is in motion, except when starting or stopping the machine.

(7) Do not use the foot brake to stop the tub while the tub is rotating at high speed.

(8) Adhere strictly to the manufacturer's precautions as to the frequency of starting and stopping the machine.

(9) Do not leave the brake on when the extractor is empty.

(10) Inspect hoists and monorail equipment daily to determine whether they are in proper condition.

(11) Never walk or stand beneath a raised extractor basket.

(12) The extractor should be provided with a drain to carry away suds and water without wetting the floor.

c. Drying Tumbler

(1) Be sure the power is off while loading or unloading the machine.

(2) Never overload the machine.

(3) The tumbler shall be equipped with an approved means of holding the doors or covers on cylinders and outer shell open while loading or unloading the machine.

(4) Inspect daily the balancing mechanisms and safety latches to insure that the door will be secure when open.

(5) The interlocks on the doors, which prevent the cylinder and fan from rotating when the doors are open, shall be inspected daily to determine that they are in proper working condition.

(6) High speed tumblers should be equipped with a dial or other approved means of indicating the position of the cylinder doors in relation to the case door.

(7) Be sure that the cylinder doors are latched and that the latch handles are secured in their wells before the machine is started.

(8) Never open the door while the tumbler is in motion.

(9) Clean lint from tumbler screens after every four hours of operation. Dispose of it immediately, by placing it in a container and covering it with water.

(10) Sufficient moisture should be maintained to prevent fires. Clothes should be removed from tumbler when dried to a weight not exceeding 30% above dry weight of clothes.

(11) Make sure that fans, feed belts, and cylinder drive mechanisms are enclosed in metal guards.

d. Mangle

(1) Keep hands at least 6 inches from the rollers when operating the machine.

(2) Never overlap pieces being run through the machine.

(3) When an article has started to pass through the rollers, never attempt to withdraw it.

(4) If an article becomes bound or fouled shut off the current and loosen the rollers. Do not attempt to extract the article in any other manner.

MT-PWHD-005567

0008 1249

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JM 83

(5) The machine shall be equipped with a safety guard across the front of the feed rollers which will quickly stop the rollers when the guard is struck with the hand.

(6) This guard shall be inspected daily to determine that it is functioning properly.

(7) Do not operate the mangle when this safety guard is not functioning properly.

e. **Press**

(1) Nobody but the operator should be permitted to stand close to the press when it is in use.

(2) Keep hands clear of the buck when the head is coming down.

(3) Air-operated presses are equipped with two push-button operating valves for safety. The arrangement is such that both hands must be used to close the press, thereby making it impossible for a hand of the operator to be caught in the press. *In no case shall either of these valves be by passed or left permanently open.*

(4) Release the head when the press is not in use.

(5) When releasing the head, be sure nobody is standing at either end of the machine.

(6) Each press, excluding the hand or foot operated types, shall be equipped with an approved safety device which will prevent the operator's fingers being caught in the machine.

f. **Hand Iron**

(1) Each electrically heated iron shall be equipped with a pilot light to indicate when the current is on.

(2) Each iron shall be turned off and disconnected immediately after use and placed until cool where there is no danger of burning to articles or to personnel.

(3) Each iron shall be equipped with a rubber sheathed, moisture resistant, asbestos insulated, 14AWG, 3-conductor heater cord in accordance with the Underwriters' Laboratory Type designation HSJ.

g. **Bundle Tying Machine.** The machine shall be equipped with an appropriate guard to prevent the operator's hands coming into contact with the moving arm.

h. **Marking Machine.** An electric marking machine shall be equipped with an appropriate guard to prevent the operator's fingers coming into contact with the marking dies.

1958

MT-PWHD-005568

REDACTED
J-M 83



1959

0008 1251

REDACTED
J-M 83

Chapter 20

HAZARDOUS MATERIALS

GENERAL

2001. SCOPE

The term *hazardous* as applied to materials covers principally those that are either flammable, are health hazards, or both. The materials included by no means represent all hazardous materials used in Navy shore activities but are representative of classes of materials or specific materials which are particularly hazardous or which Navy use experience has indicated the need for specific handling and storage precautions. Hazardous ordnance materials are not included in this Chapter (see 2003.1a).

2002. PURPOSE

The purpose of this chapter is to alert safety and supervisory personnel to the hazards involved in the use of certain materials and to provide the necessary precautionary measures. With respect to health hazards, which are primarily medical in nature, it is the intent of this chapter to supply sufficient information to enable non-medical personnel to identify the possible existence of such hazards and to provide precautionary or remedial measures which do not involve complex medical terminology (see article 2003.2).

2003. ASSISTANCE AND GUIDANCE

1. **Flammables.** For control measures applicable to the hazards of flammable materials in addition to those contained herein, safety personnel should maintain a continuous liaison with fire department personnel and should refer to the various available pertinent publications, some of which are:

U. S. Navy Fire-Fighting Manual, OPNAV Instruction 11320.15 and Fire Protection Engineering, NAVDOCKS DM-8.

National Fire Codes, Standards, Recommended Practices, and manuals of the National Fire Protection Association.

Material and Equipment Lists and Standards of the Underwriters' Laboratories, Inc.

a. **Ordnance Materials.** The hazards and precautions pertaining to ordnance material are contained in Ordnance Pamphlet 3347, *United States Navy Ordnance Safety Precautions*.

2. **Health Hazards.** The problems of occupational health involving hazardous materials are primarily the responsibility of the medical department and safety personnel should maintain a continuous liaison with that department where available. Activities not having an industrial medical officer or industrial hygiene personnel should request the assistance of off-base hygienists in accordance with the provisions of NCPI 792.

a. **Threshold Limit Values.** Annually, the Bureau of Medicine and Surgery promulgates (BUMED Instruction 6270 series) a listing of threshold limit values of materials the fumes or dusts of which are considered to be toxic in atmospheric concentrations exceeding those limits. The list is primarily for the assistance of industrial hygienists and other industrial medical personnel in appraising the health hazards of toxic atmospheres. This quantitative information is but one of several criteria required to fully evaluate the hazard of any particular environment; it is of value to safety personnel in that it provides a comparative rating of the toxic concentrations of materials which, when combined with other specific information, can be useful in estimating the severity of the hazard.

3. **Detection of Hazardous Atmospheres.** Information on the availability of instruments

1960

MT-PWHD-005570

0008 1252 REDACTED J-M 83

for the qualitative and quantitative measurement of the more common hazardous compounds may be found in the *Safety Equipment Manual*, NAVEXOS P-422, Sections 1 and 4.

ACIDS AND ALKALIES

2005. GENERAL

There are innumerable acids and alkalies used in naval shore activities in the form of pure compounds and mixtures having strong acidic or alkaline reactions. In general, acids and alkalies are similar in their injurious properties in that either may cause:

Corrosion (chemical burn) by direct contact with the skin or eyes or indirectly through the clothing.

Intoxication or suffocation by inhalation of their fumes. The fumes of some compounds are toxic or poisonous while others will displace air thereby producing a suffocating atmosphere.

Poisoning when taken internally.

Fire and explosion because of their instability under adverse storage conditions. Also, some acids are strong oxidizing agents which can generate ignition temperatures upon contact with organic materials and other chemicals.

1. Precautions. The following general precautions are to be observed in operations involving the handling of acids and alkalies.

a. Warning Signs and Labels. Signs should be posted near established operations, warning workers of the principal hazards of the operation and of the chemicals being used. All containers shall be appropriately labeled (see articles 2085-2090).

b. Showers and Eye Fountains. Safety showers and eye fountains shall be provided near work areas. Showers shall have deluge-type heads and quick-opening or automatic valves.

c. Ventilation. Where injurious fumes are habitually generated by a fixed installation, permanent exhaust ventilation shall be provided. Temporary fuming conditions may be ventilated by portable equipment, or personnel should wear respirators approved for the type and concentrations of the fumes encountered.

d. Mixing and Diluting. Unless the results of a reaction are definitely known, acids and alkalies shall not be mixed with other chemicals. Strong acids and strong oxidizing agents may react violently or produce explosive products; also, toxic gases may be evolved if acid is mixed with such chemicals as sulfides, cyanides, nitrates, and nitrites. The diluting of acids with water can generate considerable heat; acid should always be added to water, not water to acid. The addition should be done slowly with constant stirring.

2. Personal Protection

a. Protective Clothing. Workers who handle acids and alkalies should be provided, depending on the severity of exposure, with the following clothing:

(1) Chemically resistant rubber or plastic gloves.

(2) Rubber or plastic chemical goggles. Where complete face protection is required, plastic face shields should be worn in addition to the chemical goggles.

(3) Chemically resistant rubber boots or overshoes, or shoes with resistant soles, depending on the nature of the exposure.

(4) Rubber or plastic aprons.

(5) Suitable head protection in the form of protective helmets (hard hats) or soft brimmed felt hat where falling objects are not a hazard.

(6) For severe conditions requiring full protection, a rubber hood, coat and overalls or coveralls, rubber boots, and gauntlet gloves are recommended.

b. Respiratory Protection. Since gas masks are approved for maximum atmospheric

MT-PWHD-005571

0008 1253 REDACTED
J-M 83

concentration of only 2 to 3 percent of the contaminant, their use is not recommended unless it is known that the fume concentration is less and that there will be sufficient oxygen to support life (greater than 16% by volume). Self-contained breathing apparatus should be available for emergencies where neither the oxygen content nor the contaminant concentration are definitely known.

3. **First Aid.** When workers have been seriously injured by exposure to acids or alkalies, a doctor shall be summoned immediately and the following applicable first-aid procedures initiated unless otherwise directed by medical advice:

a. **Chemical Skin Burns.** The affected skin area shall be flushed with clean water for 15 minutes. When comparatively large areas of the body and clothing are affected, the individual should be placed in a deluge shower (see 2005.1b) immediately and the saturated clothing removed as soon as possible.

b. **Chemical Eye Burns.** Acids and alkalies act very rapidly on the eyes and may cause blindness unless washed out with water immediately. Allow water from an eye fountain (see 2005.1b), drinking fountain, or from a hose under moderate pressure to flow into the opened eyes and continue to flush for 15 minutes.

c. **Neutralizers.** Unless otherwise authorized by the medical department, chemical neutralizing solutions shall *not* be used to flush the skin or eyes. Only copious quantities of clean water shall be used.

d. **Inhalation.** Workers exposed to acid or alkali fumes should be removed to an uncontaminated area and kept under observation until the probability of developing complications or delayed pulmonary reaction is no longer present. If oxygen inhalation apparatus is available, oxygen may be administered but only by a person authorized by a physician. If the patient is overcome and apparently not breathing, artificial respiration should be started immediately.

e. **Ingestion.** When acids or alkalies are taken internally, antidotes should be given at once. The following procedures are to be followed unless a physician advises otherwise:

(1) Acids. Give either 3 tablespoons of milk of magnesia or the whites of 12 eggs in several glasses of water or give several glasses of milk. *Avoid causing vomiting.*

(2) Alkalies. Give 2 tablespoons of vinegar in 2 glasses of water followed with the whites of 2 eggs or 6 tablespoons of olive or cooking oil. *Avoid causing vomiting.*

2006. ACID TRANSFER

The following precautions are applicable to the transferring of acids from and to the various types of containers and to the handling of acids in such containers.

1. **Tank Trucks**

a. **Responsibility.** Supervision and responsibility for unloading procedure shall be assigned to a particular individual.

b. **Unloading Site.** Unloading should preferably be done in daylight. When it is necessary to unload at night, adequate lighting shall be provided in the area involved in the operation. The immediate truck parking area should be elevated so that leakage and spillage will drain away from the truck and adjacent structures. A hose with running water and appropriate approved breathing apparatus shall be near at hand.

c. **Truck Position.** To provide for quick removal of truck in the event of an emergency, the truck should be positioned so that it can be driven away in the forward direction. The brakes shall be set, wheels blocked, and the tank grounded.

d. **Restricted Area.** The number of personnel permitted in the unloading area shall be restricted to those required to perform the operation and the area shall be posted prohibiting entrance by unauthorized personnel.

1962

MT-PWHD-005572

0008 1254 REDACTED J-M 83

e. **Gauging.** The depth of acid in the truck and receiving tanks shall be checked and the capacity of storage tank to receive the delivery ascertained. Sufficient ullage shall be left in storage tank to prevent overflow and buildup of excessive pressure incident to expansion of the acid with anticipated variations in storage temperatures.

f. **Connecting and Pumping.** Personnel making connections and disconnections should be provided with complete protective clothing. Such protected personnel should stand by during pumping and be ready to act in case of an emergency. Before pumping is started, check receiving tank vents for proper operation and insure that the unloading line from truck to receiving tank is open and all branch lines are closed. If leakage, spill, or overflow should occur during the transfer, the pump should be stopped, valves closed, and the spill cleaned up before other actions are taken.

g. **Shut Down.** When truck tank is empty, pumping shall be stopped and all valves closed in the unloading line and storage tank vent.

2. Storage Tanks

a. **Material.** The material for tanks, piping, pumps, and valves must be carefully selected according to the type of acid and its strength. For example, steel is generally considered satisfactory for storage of technical grade sulfuric acid having a gravity of 66° Bé, whereas acid resistant linings or special alloys are required for strengths less than 52° Bé; acid resistant linings or special alloys should be used for all strengths of hydrochloric acid; and technical grade nitric acid or stronger may be stored in stainless steel or aluminum alloy tanks, the latter being preferred for strengths exceeding 95%.

b. **Foundations.** Permanent tank foundations shall be substantially constructed, preferably of concrete, and should be arranged to permit ready access for inspection of the entire tank.

c. **Vents.** Storage tanks shall be provided with vent valves of sufficient size to permit equalization of pressure while being filled and emptied, and to periodically vent vapor pressures caused by elevated atmospheric temperatures.

d. **Catch Basin.** Tanks should be surrounded with a catch basin, pit, or depression large enough to contain the full capacity of the tank in case of rupture or major leakage.

e. **Delivery.** Delivery of acid from storage tanks shall be by gravity or by pumps provided with splash shields at points of potential leakage. Air pressure shall not be used.

f. **Cleaning and Repairs.** Wherever possible tanks should be cleaned from the outside, using clean-out doors. Before any work is done on a tank, it shall be drained as completely as possible, any remaining sludge washed out with large quantities of water, the residual acid neutralized with sufficient soda ash or lime, and finally filled completely with water and drained. Any cleaning or repairing of tanks requiring hot work and/or entry of personnel shall be performed in accordance with the precautions in articles 2070 through 2080, recognizing that, in addition to toxic fumes, hydrogen generated by reaction of the acid with the tank metal may be present. Wherever possible piping should be disconnected and a blind flange installed on the open end; otherwise, valves shall be locked and tagged closed. Switches to pumps and other power driven equipment shall be tagged and locked open.

3. Drums

a. **Protection.** Personnel handling full or empty drums shall wear goggles and proper protective clothing (see 2005.2).

b. **Storing.** Filled drums should be stored under cover where they will not be exposed to direct sunlight or to excessively high temperatures. They should be off the ground with the large closure upward.

MT-PWHD-005573

c. **Venting.** The closure (above liquid level) shall be loosened at frequent intervals to relieve possible internal pressure; after venting, retighten closure.

d. **Closure Removal.** A long handled pipe or plug wrench should be used to remove closure. Face away during operation; open one full turn, and after internal pressure equalizes, the closure may be removed.

e. **Emptying.** Drums shall be emptied by gravity only, using a faucet or safety siphon. Air pressure shall not be used.

f. **Washing.** Drums to be returned to a consignor shall not be washed nor shall any water or other liquid foreign to the original contents be put into the drum.

g. **Flame and Sparks.** Open flames and any spark-producing equipment or operation shall not be permitted on or near filled or empty drums. Smoking shall be prohibited while handling or emptying drums.

4. Carboys

a. **Protection.** Goggles and proper protective clothing (see 2005.2) shall be worn when handling full or empty carboys.

b. **Handling.** Specially designed handtrucks or fork-lift trucks should be used for transporting boxed carboys. Do not use hooks; never "walk" a carboy on the bottom edges; and do not handle carboys by the closure or neck of the bottle.

c. **Opening.** When opening a carboy, turn the face away and place the hands on the side of the neck, not above the closure. Use a wire cutter to remove the wire seal; do not loosen wire by twisting or prying, this may break the neck of the bottle.

d. **Emptying.** Carboys shall be emptied by the use of a tilter designed for this purpose or by a safety siphon. Do not use air pressure.

e. **Storage.** Full and empty boxed carboys should be stored under cover and off the ground. Full carboys should not be stored more than three tiers high. Empty carboys may be stored four tiers high on their sides with their necks facing away from aisles or passageways. When removing or stacking carboys, the neck of the bottle should not be tilted toward the workman.

2007. PRINCIPAL CHEMICALS

1. **Acetic Acid.** In its strongest form, glacial acetic acid, the acid burns the skin quickly and is injurious to the eyes. The fumes are irritating to the respiratory tract and, being flammable, heat and open flames should be avoided.

2. **Carbolic Acid (phenol).** Carbolic acid has no marked action on metals but rapidly attacks the skin and eyes and is highly poisonous if swallowed. Its fumes are poisonous upon inhalation. The acid is not flammable at ordinary temperatures.

3. **Chromic Acid (Chromium Trioxide).** Chromic acid is a strong acid and a powerful oxidizing agent. Concentrated solutions attack most common metals at elevated temperatures. It reacts rapidly with many organic materials and may ignite such materials upon immediate or prolonged contact. The solid acid or concentrated solutions destroy body tissues and cause severe burns. Contact with the eyes may result in loss of sight if not treated promptly. Chromic acid dust or mist is very irritating to the respiratory tract. Prolonged exposure to the fumes from chromic acid plating baths can cause ulcerations of the skin and nasal passages.

4. **Hydrochloric Acid.** Hydrochloric acid is very corrosive to most metals, with evolution of highly flammable hydrogen gas. The acid and its gaseous form, hydrogen chloride, can cause severe burns on contact with the body or eyes or if taken internally. Its fumes are highly irritating to the eyes and respiratory tract. Neither the gas nor the acid solution in itself is flammable.

5. **Hydrofluoric Acid.** The acid is a water solution of hydrogen fluoride which vaporizes at temperatures above 67° F. The

MT-PWHD-005574

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J-M 83

acid and its vapors will attack glass, certain metals, and many organic materials. In its reaction with metals, highly flammable hydrogen gas is formed. Hydrofluoric acid in itself is nonflammable. Acid solutions and the fumes in contact with any part of the body may immediately cause serious burns and are extremely irritating to the respiratory tract and the eyes. If the acid is not immediately removed from the eyes by thorough irrigation with water, there may be prolonged or permanent visual damage or total loss of vision.

6. **Nitric Acid.** Nitric acid vigorously attacks most common metals. It attacks most organic materials and may cause spontaneous ignition upon contact with such materials as sawdust, excelsior, wood shavings, paper, and cotton waste. Under certain conditions, the acid or its fumes will nitrate cellulosic materials such as wood or cotton which greatly increases their flammability. As with other strong acids, nitric acid is very corrosive to body tissues and will cause serious burns and eye injuries. The fumes are particularly toxic when inhaled, causing immediate respiratory irritation; and prolonged exposure may cause lung congestion (pulmonary edema). The onset of symptoms following inhalation may be delayed for several hours.

7. **Mixed Acid.** Mixed acid is a mixture of nitric and sulfuric acids, the hazards of which are primarily those of nitric acid (see 2007.6).

8. **Oxalic Acid.** Oxalic acid is a colorless and odorless crystalline solid. In solution it has a weak action on metals and slightly corrodes the skin. It is poisonous if taken internally or the dust inhaled. It is not flammable.

9. **Sulfuric Acid.** Due to its corrosive and oxidizing properties, sulfuric acid attacks most metals and produces severe burns upon contact with body tissues of any kind. Its fumes are irritating to the eyes and respiratory tract. The acid is not flammable but strong concentrations may cause ignition upon contact with liquids and solids. It also generates highly flammable hydrogen gas by its reaction with most metals.

10. **Sodium Bisulfate (Sodium Acid Sulfate).** Although sodium bisulphate is not classed as an acid, in solution it is strongly acid in reaction and is used as a substitute for sulfuric acid.

11. **Ammonia.** Ammonia is a colorless gas which is severely irritating to the skin, eyes, and respiratory tract. The water solution of the gas, known as ammonium hydroxide and commonly used in industry and the household, gives off ammonia fumes which are harmful to the eyes and respiratory tract.

12. **Caustic Potash (Potassium Hydroxide).** See caustic soda (2007.13).

13. **Caustic Soda (Sodium Hydroxide, Lye).** Caustic soda is a strong alkali and in the solid form or in solution produces severe tissue and eye burns. Caustic soda dust or mist is very irritating to the eyes and respiratory tract. It is not flammable.

14. **Soda Ash (Sodium Carbonate).** Soda ash is a fine crystalline powder. Its solutions are irritating to the eye. Soda ash dust is irritating to the eyes and respiratory tract.

MT-PWHD-005575

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J-M 83

2010. DEFINITION AND SCOPE

This section deals with general precautions for petroleum fuels such as gasoline, diesel oil, kerosene, pentane, heptane, octane, and leaded fuels. Specific directives for dock loading will be found in Chapter 6 and for aviation fueling in Chapter 4. Specific problems connected with a particular field of activity are covered in the appropriate chapter. Propane, butane, and other liquefied petroleum gases, will be found in articles 2040 - 2049.

2011. INSTRUCTION OF PERSONNEL

Because of the hazards involved in the widespread use of gasoline and other petroleum fuels and the varying circumstances under which they are handled, it is important that thorough instructions be given all personnel concerning these dangers and the methods of preventing fires and explosions.

2012. FLASH POINT

The hazards of handling petroleum products are related to flash point. The flash point of a liquid is the lowest temperature at which it gives off vapor near the surface of the liquid or within a vessel in sufficient quantity to form flammable mixtures with air. Products which give off flammable vapors at or below 80°F., such as gasoline, solvents, and most crude oils are the most hazardous of all petroleum products to handle. For example, gasoline has a flash point of about -45° and crude oil has a flash point of 60°F. Certain petroleum products are slightly less hazardous to handle, such as kerosene, light and heavy fuels and lubricating oil which have a flash point above 80°F. Kerosene has a flash point of about 115°F. and will not ignite at ordinary atmospheric temperatures – but if it is heated above 110°F., it will give off sufficient vapors to burn and may explode under certain conditions described in article 2021.1.

2013. STORAGE

In addition to the following precautions, petroleum fuels shall be stored in accordance with the procedures and precautions of *Military Standardization Handbook for Petroleum Operations*, MIL-HDBK-201:

1. **Construction Features.** Nonflammable materials should be used for construction of building in which hydrocarbons and other flammables will be stored. Open type structures are preferred.

2. **Aboveground Tanks.** For large aboveground tanks, concrete, earthen, or other nonflammable berms are required.

3. **Lighting.** Explosion-proof type fixtures shall be used.

4. **Ventilation.** Natural ventilation of open type buildings is sufficient.

5. **Lightning.** Storage spaces should be adequately protected from lightning by use of lightning arresters.

6. **Inspection.** Containers should be periodically inspected for leaks at bungs and chimes, and bungs tightened using a new gasket if necessary to stop leaks.

7. **Surroundings.** The area surrounding hydrocarbon fuel storage should be clear in order to cut down the spread of fire should it occur.

8. **Motor Vehicles.** The exhaust of motor vehicles and the stacks of coal burning engines shall be equipped with an anti-spark device (flame arrester) when working in or adjacent to the area surrounding hydrocarbon fuel storage.

2014. FACTORS NECESSARY FOR COMBUSTION

1. **Fuel.** Fuel in the form of vapor must be present when anything burns, because it is not the actual substance which is con-

1965

MT-PWHD-005576

0008 1258 REDACTED J-M 83

sumed by the flame, but the vapor of the substance in combination with the oxygen of the air. A piece of wood held in a flame will not catch fire until it has been heated to a point where vapor is given off. As previously stated, some petroleum products give off flammable vapors at or below 80°F., and therefore constitute greater fire hazards at lower ambient temperatures than those products with a higher flash point. Gasoline, a highly volatile, flammable product, will vaporize at ordinary atmospheric temperatures and pressures. Therefore, under such conditions gasoline furnishes the first factor necessary for combustion.

2. **Air.** For example, a gasoline vapor-air mixture containing from about 1 percent to 6 percent gasoline vapor would have sufficient fuel (vapor) and sufficient air (oxygen) to explode. Thus, if anywhere from 1 to 6 cubic feet of gasoline vapor were introduced into a box containing 100 cubic feet of air, a mixture would exist which would readily ignite or explode upon the introduction of flame. Explosion will not take place if the mixture is either too rich or too lean.

3. **Heat.** Sufficient heat to raise the fuel to its ignition temperature is sometimes supplied unintentionally by a number of sources such as sparks or flame, if necessary precautions are not taken. Spontaneous ignition may also ignite flammable vapors, if they are present.

4. **Occurrence.** Since all petroleum products, at given temperatures and pressures, furnish the first factor necessary for fire – namely fuel in the form of vapor – all possible sources of ignition must be effectively controlled in the presence of these products. Because of the importance of these factors of ignition in fire precautions, they are discussed at some length in the following paragraphs.

2015. FUEL OIL VAPOR

1. **Combustibility.** Fuel oil itself is nonexplosive, very difficult to ignite in bulk, and is not normally capable of spontaneous combustion. The vapor from this oil, however, is explosive when mixed with air in certain proportions described in 2021.1.

2. **Characteristics.** This vapor is heavier than air and tends to accumulate in low levels, such as bilges and bottoms of tanks, where it may remain undiscovered until ignited by a naked light or spark.

3. **Where Found.** Vapor is always present in a partly filled tank or in one that has contained fuel oil or other petroleum products unless the vapor has been removed by artificial means. It is expelled through the vents from such tanks while they are being filled.

4. **Leaking.** A fuel leak allowed to continue in any part of the fuel-burning system may result in an accumulation of enough vapor to form an explosive mixture with the air.

5. **Detection of Vapor.** Portable vapor-indicator instruments have been developed for detecting the presence of petroleum vapors, and these instruments should be freely utilized, not only for detecting vapors during the tank cleaning process described in Chapter 11 of this publication but also for detecting vapors in cofferdams, voids, and storeroom spaces in which oil leaks occur, or in which vapor is suspected to have collected.

6. **Freeing Tanks of Vapor.** Whenever a tank is to be entered or whenever any work is to be done in it requiring heated rivets, hammering, etc., or whenever such work is done in the vicinity of open tanks or pipes, all such tanks and all pipes leading to or from such tanks shall be cleared of vapors, after the fuel oil has been removed.

7. **Ventilation of Tank.** Fuel oil and other fuel tanks shall be continuously ventilated by means of a portable blower during the time that work is being done in them.

2016. CONTROLLING VAPORS

1. **Spills.** Take care that no spills occur.

2. **Overflow.** Avoid spills from overflow when loading storage tanks by gaging tanks prior to loading.

3. **Leaks.** Never neglect leaks. Make frequent inspections for leaks in tank seams,

1967

MT-PWHD-005577

0008 1259

REDACTED
J-M 83

tank shells, and pipe joints. All outlets from tanks, except vents, shall be closed.

4. **Cleaning Up Spills.** If spills or leaks occur, clean them up immediately. Gasoline-soaked ground should be washed with water or covered with sand or dry earth. The area should be policed until flammable vapor has been eliminated.

5. **Temperature Control.** When temperatures are excessively high, cool storage tanks by sprinkling, or by playing water over them.

6. **Closing Containers.** Keep gasoline containers, whether empty or full, closed tightly.

7. **Empty Containers.** Beware of empty gasoline containers since vapors may be present.

8. **Ventilation.** Insure proper ventilation of all enclosed spaces in which vapors may accumulate.

2017. ACCIDENTAL IGNITION CAUSES

Ignition of the explosive mixtures may be caused by an open light, electric spark, static discharge, spark made by striking metal, heat of the filament of broken electric lamps, smoking sparks from funnel of galley, fires under boilers, arcing of the brushes of a motor, grounds or shorts in electric circuits, arcing in any electric apparatus, opening any electric switch carrying current even in a flashlight, the turning off of an ordinary electric switch, induced electric charges formed by rubbing two surfaces together, motion of a rapidly moving belt, or by nails in shoes hitting or rubbing metal or stones. Refer to Chapter 15 of *Safety Precautions* for possible hazards due to operation nearby of radio and other electronic transmitting equipment. Ignition can occur in so many ways that reliance cannot be placed upon safety measures designed to control this feature alone, and the most careful precaution is necessary to prevent the accumulation of gasoline vapor. However, the following precautions shall be most strictly observed and eternal vigilance maintained to prevent the ignition of fuel vapors.

1. **Naked Lights.** While oil, gasoline, and other hydrocarbons are being received or discharged, naked lights, smoking and electrical apparatus liable to spark shall not be permitted on board ship or within 50 feet of an oil hose, tank, compartment containing a tank, pump, or the vent from a tank. The carrying of matches or cigarette lighters on the person while at work loading, unloading, or cleaning tanks shall be prohibited. Portable lights of all kinds shall be explosion-proof in the vicinity of gasoline and vapor-proof in the vicinity of fuel oil. Their wires shall be well insulated.

2. **Smoking.** "No Smoking" signs and other appropriate visual warnings shall be conspicuously posted in the vicinity of loading and handling of petroleum products and the cleaning of tanks.

3. **Bearer of Naked Light.** No tugboat, locomotive, automobile, or other gasoline or diesel propelled equipment will be allowed to approach within 200 feet of loading operations unless specific approval is granted by appropriate supervisory personnel.

4. **Clothing.** Men engaged in loading, unloading or cleaning tanks shall not wear boots or shoes with exposed nails or metal fastenings. Do not allow any buttons made of sparking metal to be exposed. Beware of key chains, belt buckles, and tools in pockets. In highly hazardous areas, personnel are not permitted to wear outer or under garments made of wool, silk, or synthetic textiles such as rayon and nylon, as these materials can generate sufficient static electricity to cause ignition of highly flammable products.

5. **Static Electricity.**

a. **Danger.** Dangerous static charges are frequently accumulated and discharged in such a way that fires and explosions result unless proper precautions are taken.

b. **Fluid Flow.** Static electricity is produced when gasoline or similar flammable liquids undergo movement such as flow through a hose, agitation of petroleum liquid, or when poured from one receptacle to another or when passed through a filter.

1965

MT-PWHD-005578

c. **Moving Machinery.** Moving parts of machines, particularly in dry atmospheres may cause static electricity. Grounding of machines prevents the accumulation of dangerous charges. Moving belts which are not electrically conductive, such as those employed for conveyors and power transmission are also sources of static electricity. One method of combating this source is the use of rubber belting containing a conducting component.

d. **Bonding Nozzle.** The metal nozzle at the end of gasoline or other fueling hose should be bonded to the coupling which is attached to the pump by a copper wire inside the hose and the nozzle should be held in contact with any metal tank or receptacle which is being filled with gasoline. An induced charge of electricity of considerable voltage may be accumulated by the friction of fuel flowing through a metal funnel when loosely placed over the inlet of a container being filled. Therefore, the funnel should be in metallic contact with the supply outlet.

e. **Bonding Receptacles.** All metal receptacles, funnels, etc., used in the handling of gasoline should be in contact with each other or should be bonded together and grounded.

6. **Electrical Storms.** Never load or unload flammable products during electrical storms.

7. **Repair Work.** Do not perform any repair work involving hot work such as burning, cutting, or welding unless a permit is issued by proper authority.

8. **Sparks From Tools.** Hammering of dogs, wing-nuts, hatches, etc., shall never be permitted around highly volatile and explosive fuels such as gasoline or JP-4, except in cases of necessity. If hammering is necessary, wooden or rubber mallets shall be used. Requirements for the use of nonferrous ("non-sparking") tools in working around fuels shall be in accordance with local or cognizant bureau instructions.

9. **Spontaneous Ignition.** If large masses of certain combustible materials which have been soaked in oil are allowed to stand and the heat liberated from the slow oxidation process is not allowed to escape, the temperature of the mass rises. If this heating is allowed to proceed, the material reaches its ignition temperature and starts to burn. Thus accumulation of oily waste or paint-soaked rags in combustible buildings and containers is a cause of fires. For this reason materials subject to spontaneous ignition must be stored in a way least likely to accelerate oxidation and most likely to cause any heat of oxidation to be absorbed by the surroundings. Use only self-closing metal receptacles for discarding oily waste and dispose of such collections daily.

10. **Electrical Apparatus.** Inspect electrical apparatus frequently and correct any condition likely to cause sparking. Whenever possible, open switches and pull fuses before work is done on electrical equipment.

11. **Engine Operation.** Shut off gasoline tank-truck engines during the entire period of filling or discharging unless the truck is designed for engine operation to drive transfer pumps through a power take-off or unless the truck is approved for using gasoline in engines for operating pumps.

12. **Vents.** Care shall be taken that the flame arresters in the vent pipes from tanks are kept intact and smoking, sparks, or flames shall not be permitted in the immediate vicinity of such vents. The flame arresters shall be kept free from paint and accumulations of soot or lint.

2018. FIRE FIGHTING EQUIPMENT

Specifications and instructions relative to the care, use, location, etc., of fire-extinguishing equipment are given in the *United States Navy Structural Fire-Fighting Manual*, OPNAV Instruction 11320.15.

2019. EXTINGUISHING FIRES

1. **Methods.** A petroleum product fire can best be extinguished by smothering. Foam extinguishers and carbon dioxide are the preferred extinguishers. Chemicals or water in the form of fog may be used. Sand and steam are also effective.

0008 1261 REDACTED J-M 83

2. **Fire in Adjacent Space.** In the event of fire in an adjacent space, the sprinkler system, if provided and manually controlled, should be placed in operation so that the drums and structures may be thoroughly drenched during the continuation of the fire. On shipboard the drainage pumps should be operated so as to carry away the water. Where no sprinkler system is provided and steam smothering is available, the space containing gasoline should be kept sealed and the steam smothering turned on. If sprinkling and steam smothering are not available, fog nozzles attached to hoses from fire plugs should be used for drenching the drums and structures.

2020. HEALTH HAZARDS

Petroleum fuel vapors may cause anesthetic effects when inhaled. Inhalation of atmospheres containing 0.07 to 0.28 percent by volume of gasoline vapors (equivalent to about 5 to 22 percent of the lower explosive limit) may cause slight dizziness in some individuals after 3 minutes exposure; 1.1 to 2.2 percent causes severe dizziness after 3 minutes, and inhalation of 2.2 to 2.6 percent by volume causes intoxication after 10 to 12 breaths. Longer exposure or greater concentrations may cause unconsciousness or death.

1. **Permissible Limit.** The maximum permissible concentration of petroleum vapors in which it is safe for personnel to work an 8-hour day is 500 parts per million (0.05 percent by volume). Since the lower explosive limit is 1 to 1¼ percent for most fuels, it should be remembered that the concentration of vapors which can be tolerated by personnel is far below that required to produce explosive mixtures with air.

2. Symptoms. First symptoms of exposure to toxic vapors are headaches, nausea, and dizziness. If such symptoms are noted, they should be taken as warning of the presence of dangerous amounts of vapors in the air. Recovery from these early symptoms is usually prompt after removal to fresh air. However, if men are overcome by vapors, they should receive immediate medical attention. First aid consists of prevention of chilling and of the application of artificial respiration if breathing has stopped.

3. **Leaded Gasoline.** The toxicity of heavy concentrations of vapors from gasoline or other fuel is increased if it contains tetraethyllead or similar compounds added for antiknock purposes. These lead compounds may be inhaled with the fumes or may enter the body through the mouth or by absorption through the skin and are very poisonous.

a. **Contaminated Tanks.** No tank used for leaded gasoline shall be assumed to be free from the hazard of lead poisoning until the tank has been thoroughly cleaned, even though the combustible gas indicator shows that it is free of gasoline vapor. Special protective clothing and a fresh air hose mask must be worn until such time as the tank is declared lead free (see paragraph 6 below).

b. **Repeated Exposure.** Lead poisoning may result from repeated exposure to gasoline vapors in an enclosed or inadequately ventilated area where leaded gasoline has been spilled in considerable quantity. There is also a danger of lead poisoning from fumes given off by stoves or other gasoline burning equipment in which leaded fuel is used. Therefore a deleading device should be used and adequate ventilation should be insured. If operating personnel are exposed persistently to leaded gasoline, they should be rotated on the job in order to limit the period of individual exposure.

4. **Injury to Skin and Eyes**

a. **Contact.** Gasoline may cause skin irritations if allowed to remain in contact with the skin, particularly under soaked clothing or gloves. Clothing or shoes through which gasoline has soaked should be removed at once. Gasoline should be washed from the skin with soap and water. Repeated contact with gasoline removes the protective oils from the skin and causes drying, roughening, chapping, and cracking, and in some cases infections of the skin which may become serious.

b. **Gloves.** Oil-resistant rubber

1970

MT-PWHD-005580

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J-M 83

gloves should be worn as protection by persons handling petroleum products.

c. Gasoline as Cleaner. Gasoline shall not be used for cleaning purposes under any circumstances.

5. Swallowing Gasoline. If a person swallows gasoline, first-aid should be given immediately. Give the victim a half cup of olive or cooking oil and several cups of strong coffee or tea. *Do not cause vomiting.* Medical attention should be obtained immediately.

6. Entering Tanks. No person shall be required or permitted to enter a tank which has contained liquid petroleum fuel except under the conditions and observing the precautions prescribed in NAVDOCKS P-342, *Fuel Storage Tank Cleaning at the Shore Establishment (Finished Product Tanks).*

2021. GASOLINE

Gasoline is a highly volatile liquid giving off a vapor which, when combined with air in the proper proportion, forms an explosive mixture that can be set off by a slight spark or flame. A violent explosion, followed by fire if liquid gasoline is present, will result. Air at ordinary atmospheric temperatures can absorb as much as 28 percent of gasoline vapor, the amount depending on the volatility and grade of the gasoline, the most volatile grades causing the higher percentages.

1. Formation of Explosive Mixture

a. Amount of Gasoline Required. The lower limit of explosibility of gasoline vapor and air is about 1 percent gasoline vapor by volume while the higher limit is about 6 percent gasoline vapor by volume in air. One quart of gasoline left exposed in a closed space will render explosive upon complete evaporation under ideal conditions about 520 cubic feet of air, or a space of 10 by 6½ by 8 feet. One cubic inch of gasoline will do the same thing for a space of 9 cubic feet or a space 3 by 3 by 1 foot. These figures will give an idea of the small amount of gasoline needed to produce a large volume of explosive mixtures.

b. Burning Vapor. Under certain conditions, gasoline or gasoline vapor will burn freely and without explosion if ignited immediately after it is spilled and before there is time for the formation of more than a small volume of explosive vapor.

c. Heating Container. A fire on or near a container of gasoline having a restricted opening may generate enough heat to vaporize the gasoline too rapidly for an explosion to occur inside the container. The vapor thus generated will issue from the opening at a high rate and burn as it mixes with the air. However, if the opening is too small, the vapor pressure may build up and burst the container.

2. Behavior of Gasoline Vapor

a. Dangerous Quantities of Vapor. Gasoline vapor is heavier than air, and the highest percentage of vapor in air will be found near the bottom of the storage space; however the vapor will gradually spread throughout the whole space. It should be recognized that, due to the difficulty of preventing small leaks, danger from sparks or flame is always present wherever gasoline is used or stored. It is, therefore, of the utmost importance to prevent the accumulation of the vapor in dangerous quantities; this can usually be done by proper ventilation.

b. Vapor Movement. A dangerous feature of gasoline vapor is that it may travel along a current of air for a considerable distance and then be ignited, the flash traveling back to the source of supply and causing an explosion or fire at some distance from the spark or flame. In this connection, wherever gasoline enters a pipe or drain line, it shall be thoroughly flushed immediately with a hose from the fire main.

c. Connected Spaces. When a space in which gasoline is left is connected as by an open pipe or drain, with other spaces, gasoline vapor may work its way to them. In such connecting spaces, therefore, there is a danger that gasoline vapor may be present which may be ignited by any source of spark or flame.

3. Handling Portable Containers

a. Designated Use. Gasoline containers shall *not* be used as containers for other

MT-PWHD-005581

0008 1263 REDACTED J-M 83

materials unless they have been previously surveyed and assigned to such materials and so marked.

b. Foreign Substances. Care shall be taken that no dirt, water, or other foreign matter is allowed to get into gasoline containers.

c. Rough Treatment. Gasoline drums are normally subject to hard usage and care shall be exercised that they are not abused. They shall not be struck together or against a structure in such a way as to cause sparks.

4. Issue. All issues of gasoline shall be made under the supervision of a reliable man who shall remain in charge until all containers are securely closed and who shall see that all safety precautions are carried out and that all chances of fire are eliminated. Drums shall be periodically inspected thereafter for leaks at bungs and chimes, and plugs tightened using a new gasket if necessary. A nonsparking metal faucet installed in a drum will be considered as fulfilling the requirements of a plug.

5. Leaky Containers

a. Detection. Inspect for leaky containers, and if any are found, immediately transfer the contents to a tight container and clear the leaking one of any vapor. Defective gaskets and plugs should be replaced.

b. Cleaning Faulty Tanks. Water shall not ordinarily be introduced into a gasoline drum, but if a leaky container cannot be made tight by tightening the filling and vent plugs, the drum shall first be filled to overflowing with water, and then emptied and blown through with a steam jet to eliminate any vapor present.

c. Disposition of Defective Containers. Defective containers, *after* they have been vapor-freed, shall be returned to a distribution depot for repairs. Repairs, especially those involving HOT WORK shall NOT be made by the unauthorized personnel except in case of emergency, and then not until the container has been vapor-freed.

6. Empty Containers. The containers shall be inspected after emptying to insure that all gasoline has been drawn off and then closed by tightening the filling and vent plugs, keeping gaskets in place. Empty containers shall be inspected before shipment for ruptured seams and punctures.

7. Handling Bulk Gasoline

a. Use of Hose. When gasoline is received in bulk, as in aircraft carriers, tenders, supply ships, or at shore stations, it shall be received by hose from the source of delivery.

b. Loading Tankers. During loading of tankers the covers of cargo tanks shall be closed but not clamped. Each tank as filled should be carefully watched, and when cargo enters expansion tanks, loading should be slowed down to guard against overflow. Gasoline should be loaded entirely through the piping. It should not be poured by hose into the hatch. Hatches and ullage plates should be secured after loading is completed.

c. Insulated Cable. Before connecting hose, an insulated copper cable, at least No. 4 U. S. gage, shall be connected between the source of supply and the receiving inlet, with sufficient slack in the wire to prevent tension.

d. Safety Switch. The cable shall remain in place until the hose is removed, and a single-pole electric ground safety switch shall be provided for easy operation at some distance from either end of the hose, insuring that no spark will occur except in the switch, which should not be opened when the hose is in place.

e. Fire Protection. A method of positive communication shall be established between fueling control points and the tanks being filled. When fueling aircraft or vehicles, or filling containers, a CO_2 portable fire extinguisher shall be at hand. Spilled fuel shall immediately be swabbed up or flushed off with water.

8. Electrical Bonding. Electrical bonding wires are fabricated into the hose wall to ground the hose terminals. The No. 4 gage cable is also connected to these hose terminals as added precaution to guard against the accidental failure of the hose and hose wire under excessive stress. Failure of the

1972

MT-PWHD-005582

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J-M 83

hose wire might give a spark which could ignite the gasoline flowing from the break in the hose. This spark is avoided by the use of the alternate ground wire, which is long enough to remain intact when beyond the point at which the hose would fail. Some ships are equipped with quick release hose couplings to avoid hose breakage under these circumstances, but the alternate ground wire is still essential.

9. Naked Lights in Vicinity. Smoking shall not be allowed and non-approved machinery shall not be operated in the vicinity of gasoline tanks or filling connections.

10. Filling Tanks. In filling gasoline tanks:

a. Do not vent through manhole or into interior space.

b. Close hatches and ports in the vicinity of outboard vents.

c. Ventilate interior spaces thoroughly after tanks are filled and secured.

11. Draining of Hose

When loading or delivery has been completed and the proper valves closed, gasoline remaining in the piping above the tanks should be drained into the tanks by drawing off water from the water side of the system where provision is made for this method of draining. Where the above provision is not made or where the slope of the piping is such that all of the gasoline in this piping and hose does not drain back into the tank, gasoline remaining in the piping and hose is drained into containers which can be closed and sealed. After using, gasoline hose should be carefully drained of all gasoline.

12. Large Gasoline Leaks

a. In cases of emergency, where it is impracticable to apply measures for optimum ventilation, whether due to lack of facilities for ventilation, or excessive accumulation of gasoline and gasoline vapor, the most drastic precautions should be exercised along the following lines:

(1) Remove all personnel from the contaminated spaces. Post a sentry to warn off personnel, and eliminate possible sources of ignition in the area until the regular fire and repair parties arrive.

(2) Stop all electrical machinery (except explosion-proof inclosed motors), turn off all electronic transmitting equipment and turn off all electric lights (except explosion-proof type) both in the compartment and in immediately adjacent passageways through which air currents might pass from the compartment containing gasoline. Do not operate switches and electric controllers inside these vapor filled compartments. Open the circuits at control stations outside of compartments affected.

(3) Exercise all possible precautions to prevent accidental sparking from either electrical or mechanical sources, both in the compartment and in passageways immediately adjacent. See Chapter 15 for possible hazards due to operation of electronic transmitting equipment.

(4) Close and if necessary seal the compartment. Efficient rescue breathing apparatus shall be used by competent personnel entering the compartment; only explosion-proof lights should be used. Footgear and implements used by personnel entering the compartment shall be of such character as to eliminate the risk of striking sparks.

(5) The outer boundaries of the affected compartment should be kept under observation for gasoline leakage. Such boundaries may not be tight against gasoline, and the precautionary steps mentioned above may have to be repeated for adjacent compartments.

(6) Use a portable combustible-gas indicator for positive determination of the existence of gasoline vapor when there is any possibility of suspicion that such vapors may exist in a compartment. *Do not rely upon your sense of smell.*

(7) Do not undertake any repairs to or in such compartments until it is practicable to take the precautions specified in welding and allied processes (see articles 1054 and 2070-2080).

MT-PWHD-005583

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J-M 83

2022. JP-5 FUEL

1. **Characteristics.** Several types of special fuels were developed for jet engine propulsion. These are commonly known as JP fuels. The JP fuels used by the military services are procured under military specifications. They are all composed of hydrocarbons, with additions of chemical agents as required. The most widely used, because of its low hazard characteristics, is JP-5. JP-5, procured under MIL-J-5624, is a high flash point kerosene-type fuel with a vapor pressure about zero psi. The flash point is specified to be a minimum of 140° F. Since the REID vapor pressure of JP-5 is so low, the vapor-air mixture in tanks above the liquid surface will be too lean, under normal conditions, to be easily ignited. Because of this and because the fuel has a relatively high flash point, the fuel is authorized for use in ships since it presents a relatively negligible fire and explosion hazard when normal precautionary measures are employed in storage and handling.

2. **Health Hazards.** See Article 2020.

LIQUID PROPELLANTS AND OXIDIZERS

2030. CHARACTERISTICS AND PRECAUTIONS

The physical and chemical properties and the safety precautions and health hazards pertaining to the use and storage of missile liquid propellants are to be found in the publication: *The Handling and Storage of Liquid Propellants*, Office of the Director of Defense Research and Engineering (obtainable from the Government Printing Office), and *Ordnance Manual*, NAVWEPS OP-3199.

COAL

2035. HANDLING

1. **Railroad Cars**

a. A safety wrench should be in the possession of every worker on coal unloading operations to open hopper bottom railroad cars. These wrenches have handles of sufficient length to provide ample leverage, while the ratchet is so designed as to prevent spinning. Care should be exercised so that the wrench handle is straight at all times, as a bent bar will slip sideways. A safety disc should be used between the wrench handle and the car to prevent injury to the hands of workmen.

b. Extreme care should be exercised by men when entering coal cars during unloading operations to prevent being caught in the slide of the coal and injured or suffocated.

c. When men are engaged in discharging coal cars, blue flags shall be placed near the car or attached to the car track to prevent the possibility of a switching engine moving the car without notice.

d. The use of a shovel, tool, or bar with a broad flat blade and a handle approximately eight feet in length is necessary equipment for safely removing wet coal from the sides of the cars. An extension pipe with an inserted handle attached to a steam hose should be used to free frozen coal from cars whenever thawing sheds or other automatic equipment is not available.

MT-PWHD-005584

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2. **Coal Bins**

a. Ventilation. There should be adequate ventilation for coal bins. Coal bins (especially those used in storing pulverized coal) should be located as far as possible from any source of flame or heat.

b. Crushers. If coal crushers are used all equipment should be guarded and the crusher bins should be properly lighted and drained.

3. Machinery. When using coal unloaders, stackers, cranes, and other handling machinery, care should be taken to keep away from moving parts and such parts should be properly safeguarded. No repairs should be made while machinery is in operation.

2036. DANGER OF SPONTANEOUS IGNITION

1. Storage Areas. The storage area should be centrally situated on high ground, suitably graded, drained, and surfaced. The storage space should be free from all foreign matter such as leaves, grass, weeds, metal, papers, rags, oil, waste, and piles of wood, and if possible it should have concrete or other hard surface base.

2. **Bituminous Coal Storage**

a. Layers. Bituminous coal should be stored in layers of about three feet in thickness. Each layer should be spread evenly and rolled down with a bulldozer. Generally, piles should not exceed 18 feet in height.

b. Firing Characteristics. Coal susceptible to spontaneous ignition should be subjected to the layer and rolling process, but piles should not exceed 16 feet in height.

c. Sub-Bituminous coals ignite spontaneously very readily and should not be stored.

3. Inspection. Coal piles should be inspected frequently to detect smoke, odor of coal gas, or other indications of heating. Also temperatures of piles should be determined by placing pipes, which are closed and pointed at one end, into the pile to a depth of 6 feet and about 15 feet apart, and inserting thermometers to the bottom of the pipe by the use of strings. If the temperature at any point reaches 180°F. or over, the situation is dangerous and the coal where this temperature prevails should be promptly used in the boilers or turned over.

4. Extinguishing Coal Fire. When smouldering or fire has developed in a coal pile, the coal must be promptly used or dug out and spread in thin layers on the ground away from the main pile. Water is not effective and should not be used in an effort to put out a fire in a coal pile.

5. Anthracite Storage. Anthracite will not ignite spontaneously and no special precautionary measures are necessary in the storage of anthracite. Ordinarily coal with from 1 percent to 2 percent sulphur will not fire readily and can be safely stored. However, coals containing 2 percent or more of sulphur will ignite more readily and require special precautionary measures in storing.

6. Additional Information. If the safe storage and handling of coal presents any particular problems, communicate directly with the Fuel Division, Bureau of Supplies and Accounts, Navy Department, Washington, D. C. 20360 for information.

COMPRESSED GASES AND CYLINDERS

2040. SCOPE

1. Application. The instructions in this chapter apply to compressed or liquefied gases used by Navy installations. Cylinders shall be fabricated and tested under Interstate Commerce Commission regulations. The instructions also apply to valves and auxiliary equipment such as safety devices, cylinder caps, etc. Strict compliance with the precautions prescribed in this chapter will prevent many of the accidents which result from misapplication, mishandling, or improper identification of industrial gases and cylinders in the naval service. For instructions

1975

MT-PWHD-005585

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covering specific applications of these gases and cylinders, such as oxygen and acetylene used in welding and cutting, see Chapter 10.

2. **Emergencies.** Due allowance should be made for the hazards which may be peculiar or incident to local conditions of handling, stowage, and use. Where such conditional hazards are met or noted in the course of operations, they should be reported to the cognizant bureau for dissemination to other commands.

3. **Medical Instruction.** Where reference is made to first aid for personnel exposed to gas fumes, it should not be assumed that every acceptable procedure is included, or that the services of medical officers are unnecessary. The instructions of medical officers, if available, shall be followed in every case.

2041. VALVE SAFETY DEVICES

Military specifications and Interstate Commerce Commission regulations require that valves designed for certain services be fitted with safety devices as a safeguard against the building up of hazardous pressures within cylinders from exposure to heat, or from overcharging, etc. In general these safety devices may be divided into four categories based on functional design.

1. **Fusible Plugs.** A fusible plug may be described as a threaded hex head plug, the center of which is filled with fusible metal. When the cylinder is subjected to high temperatures, the fusible metal melts, permitting gas to escape through the channel previously filled with fusible metal. This type of device is used on chlorine, Freon, acetylene, etc.

2. **Spring-Loaded Safety Device.** Spring-loaded safety devices usually function as "pop" valves when internal pressure in cylinders overcome spring tension, permitting escape of gas. Devices of this sort are used on liquefied petroleum gas valves, and operate generally at about 1.56 percent of the charging pressure indicated for the cylinders (Interstate Commerce Commission approved pressure).

3. **Unbacked Safety Cap with Rupture Disk.** Unbacked safety caps with rupture disks consist essentially of a safety cap covering a safety port in the valves. The cap retains a disk firmly over the safety port. Under excessive pressure (2,600-3,000 p. s. i.) the safety disk ruptures and allows the gas in the cylinder to vent to atmosphere. This type of safety device is used in carbon dioxide service.

4. **Backed Safety Cap With Rupture Disk.** Backed safety caps with rupture disks are essentially the same as described in paragraph 3 above, except that the disk is supported by fusible metal contained in the safety caps and blocking off escape ports. In practice, where the cylinders, valves, and, of course, the fusible metals are heated above the melting temperature, and the pressure within the cylinders then is or thereafter approaches 2,600-3,000 p. s. i., the disk ruptures and reduces the pressure. This type of device is used commonly on air, helium, hydrogen, nitrogen, and oxygen valves.

5. **Tampering.** Do not tamper with the safety devices on valves or cylinders.

6. **Striking.** Never hammer or strike the valve wheel in attempting to open or close valves. Use only wrenches or tools provided and approved for this purpose.

7. **Connections.** Be sure that the threads on regulators or other auxiliary equipment are the same as those on cylinder valve outlets. Never force connections that do not fit.

8. **Ice Clogged Outlets.** In the event that valve outlets have become clogged with ice and it becomes necessary to thaw them out, use warm, not boiling water. Boiling water will melt fusible plugs and vent cylinders.

2042. PAINTING

1. **Frequency.** It shall be the responsibility of all commands to repaint cylinders to minimize external corrosion. Repainting shall be done no oftener than is considered necessary for preservation. Navy standard

MT-PWHD-005586

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REDACTED
J-M 83

paints are formulated to withstand scrubbing and fading, so that touch-up patch painting is not too obvious. Therefore, touching up rather than complete repainting shall be done when practicable. Repainting in lieu of cleaning must never be permitted.

2. **Color.** It is also required that each cylinder be identified, with respect to gases or fluids contained therein, by the color of the paints applied for preservation. The colors shall be in accordance with *Military Standard Color Code for Pipelines and for Compressed Gas Cylinders*, MIL - STD - 101.

2043. REPAIRING CYLINDERS AND VALVES

1. **Maintenance.** Cylinders shall be repaired only by personnel who are specifically authorized to perform such work. To assure that all cylinders are in satisfactory and serviceable condition, periodic inspections should be made; cylinders found with any of the following defects should be drained and purged of gas and turned into the nearest naval supply point, in exchange for other cylinders:

a. Severely dented, gouged, or corroded.

b. Evidence of fire damage (carbon deposits on valves or safety plugs of cylinders containing acetylene or other flammable gases).

c. Bulges (deformation of cylinders from internal pressures).

d. Damaged, split, or leaking seams (low-pressure cylinders containing flammable gases such as acetylene, etc.).

2. **Valves.** In general, cylinders with leaking or defective valves (stripped threads, bent stems, etc.) shall be turned in to the nearest naval supply point for overhaul. Leakage from valves may be caused by the presence of dirt or foreign particles in the valves or the valve seat. The leakage may sometimes be corrected by partially opening and then closing the valve, to blow out the foreign material. If the leakage continues, the cylinders should be removed to a safe place (in the open if possible) and drained by opening the valve. The cylinders should then be tagged and turned in for overhaul and recharging.

3. **Draining Cylinders.** Cylinders containing combustible or toxic gases (acetylene, hydrogen, chlorine, etc.) should be drained through pressure regulators and their rates of discharge controlled so that dangerous accumulations of these gases will not occur.

4. **Toxic Gases.** The utmost caution should be exercised in draining cylinders containing chlorine, sulphur dioxide, anhydrous ammonia, and other toxic or irritant gases. Cylinders containing these gases should be discharged to atmosphere only under conditions assuring the prompt dispersal of these gases without hazard to personnel or property. Personnel engaged in draining these cylinders should be equipped with the necessary protective clothing, goggles, and respirators.

2044. CARE AND TESTING OF CYLINDERS

1. **Quinquennial Tests.** Interstate Commerce Commission regulations require that practically all cylinders with the exception of those containing acetylene be retested every five years. Regulations specify that cylinders for which prescribed retests have become due must not be charged and shipped until such retests have been properly made. However, cylinders which have been charged prior to the expiration of their retest period are satisfactory for shipment and use subsequent to the date of expiration.

2. **Refilling.** Do not refill cylinders unless such action is specifically approved by the bureau concerned and then only in accordance with instructions.

3. **Designated Gas.** Do not fill any cylinder with a gas other than that gas for which the cylinder has been specifically designated. Explosive mixtures may readily be formed when cylinders containing residual combustible gases such as hydrogen, propane, or acetylene are charged with air or oxygen. The reverse of this procedure is equally hazardous.

197

MT-PWHD-005587

0008 1269 REDACTED J-M 83

4. Changing Markings. Do not remove or change the numbers of marks stamped into cylinders without the specific approval of the cognizant bureau or Supply Demand Control Point.

5. Improper Marking. Do not use any gas cylinder which is improperly marked (color of paints, name or gas stenciled on cylinder and valve, etc.). Return all such cylinders to the nearest naval supply depot.

6. Specific Use. Never use cylinders for rollers, supports, or for any purpose other than to carry gas.

7. Regulators. Do not use regulators, pressure gages, manifolds, and related equipment which are provided for a particular gas on cylinders containing different gases.

8. Protection From Heat. Do not subject compressed gas cylinders, either in storage or in service, to a temperature in excess of 130°F. A direct flame should never be permitted to come in contact with any part of a compressed gas cylinder.

9. Protection From Abrasion. Be careful to protect cylinders from objects that will produce a cut or other abrasion in the surface of the metal.

10. Testing for Leaks. When testing for leakage from gas cylinders, use soapy water. Keep the scene of operations well clear of open flames and other sources of potential ignition, such as unshielded lamps, switches, etc.

2045. STORAGE AND HANDLING

1. Definitions

a. Storage. As used herein, the term "storage" refers to articles under the cognizance of the supply officer, in general stores, to be drawn on for the activity's own use; or articles of cargo being transported. It does not refer to articles removed from stores or cargo and transferred to shops or other locations for use.

b. Ready Service. The term "ready service" means articles that have been transferred from store and are physically located in a shop or elsewhere, regardless of whether they are actively being used at a given moment or are being held in reserve in the interim between periods of actual use or in anticipation of a need for immediate use.

2. Handling Cylinders

a. Handle With Care. Cylinders that contain flammable and/or explosive gases shall be handled with particular care. Every effort should be made to avoid their being dropped or allowed to strike forcefully against each other or any other object. Every precaution shall be taken to prevent bumping or striking the discharge valves during handling operations.

b. Caps in Place. The cylinder valve outlet cap and the cylinder valve protecting cap shall both be in place when cylinders are being handled. Unless ready service cylinders are secured in a special portable rack, regulators shall be removed and caps replaced before the cylinders are moved to a new location.

c. Transporting Cylinders. When loading or transferring cylinders, especially when using a crane or derrick, the cylinders shall be secured in a cradle, suitable platform, rack, or special container. Neither a sling (line or chain) nor electromagnets shall ever be used. A cylinder moved by hand should be tilted slightly and rolled on its bottom edge, without dragging or sliding. Hooks or lines through valve protection cap shall not be used for hoisting cylinders.

d. Hand Trucks. When cylinders are transported by hand truck, they shall be securely held in position by chains, steel strapping or other means that will prevent falling from the truck.

(1) Hand trucks used by welders for holding cylinders of welding gases shall conform in general to the requirements of *Specification Mil-T-19259, Truck, Hand 2 Wheel, Welding Cylinder Rack, Double Handle Type, Solid Rubber Tires.*

2046. STORAGE OF COMPRESSED GASES

The provisions of NAVSANDA Pub 284, (NAVMC 1101), *Storage and Materials Han-*

MT-PWHD-005588

0008 1270

REDACTED

dling, and the following precautions shall be observed in storing compressed gases:

1. Separating Flammable and Oxidizing Gases. Combustible gases shall never be stored with oxidizing gases. A fire wall shall separate such storage spaces. However, the inert gases such as helium, nitrogen, carbon dioxide, or argon may be stored with either flammable or oxidizing gases. Typical oxidizing gases are oxygen and chlorine.

2. Fire Apparatus and Oxygen Tanks. Fire extinguishers employing gases, cylinders permanently connected to fixed fire-extinguishing systems, and gases and canisters for oxygen-breathing apparatus may be stored in the vicinity in which they are used.

3. Temperature. Necessary steps shall be taken to prevent the maximum temperature in storage spaces from exceeding 130°F.

4. Ventilation. Cylinders shall be stored in well ventilated spaces provided with forced draft if necessary.

5. With Combustibles. Other flammable or combustible materials shall be kept out of storage spaces. In particular, oxygen cylinders shall not be stored near combustible materials, especially oil and grease.

6. Acetylene Cylinders. Acetylene cylinders shall be stored with valve end up.

7. Exterior Storage. Cylinders stored in the open should be protected from extremes of weather and should be screened against direct sunlight in localities where extreme temperatures prevail. Cylinders in open winter storage should be protected from accumulations of ice and snow. Any thawing of ice around cylinders or cylinder valves shall be done with warm (not boiling) water.

8. Corrosion. Steps shall be taken to prevent corrosion of the threaded connections of cylinders, which have been in storage for extended periods of time. The use of grease or flammable corrosion inhibitors on oxygen cylinders is not permitted.

2047. TOXIC HAZARDS

1. Leaking Cylinders. Particular attention should be given to location of cylinder storage to prevent entrance of fumes from leaking cylinders into ventilating air intakes leading to spaces where personnel may be affected or where flammable gases may cause explosion.

2. Chlorine and Ammonia. Chlorine and ammonia are toxic and may produce fatal results if inhaled in large quantities. In small quantities, they are irritants and cause acute distress by attacking the lung tissue.

3. Inert Gases. Helium, nitrogen, carbon dioxide, and argon are nonflammable gases and may be stowed with flammable gases. Although the inert characteristics of these gases are a fire protection, they will not support respiration, and sufficient concentration in a closed space will cause asphyxiation. Aerosol insecticide and carboxide are also nonflammable; however, where concentrations are present these gases are toxic. Freon likewise is nonflammable but in the presence of fire or red hot metal will decompose into phosgene gas, which is toxic.

2048. EMPTY CYLINDERS

1. Pressure. Though empty cylinders, with valves securely closed and valve protection caps in place, are comparatively less hazardous than full cylinders insofar as storage is concerned, the former shall be handled and stored with the same precautions as used with full cylinders. This is important since cylinders of some gases are not to be completely exhausted but should be considered empty when the gas pressure falls to about 25 p.s.i. gage.

2. Labeling. Empty cylinders should be tagged as "Empty" and segregated from full cylinders.

3. Valves Closed. Valves should be tightly closed and valve protection caps se-

MT-PWHD-005589

0008 1271

REDACTED
J-M 83

curely fastened to assure the return of empty cylinders in good condition to the suppliers.

4. **Rotation of Cylinders.** Full cylinders should be used in rotation, as received from the source of supply.

5. **Disposition.** Empty cylinders should be delivered to the nearest naval supply depot with valves closed and under some positive pressure, except where the design of the valve does not permit closing, as is the case with fire extinguishers. This is necessary to prevent condensation of atmospheric moisture in cylinders, and in the case of acetylene cylinders to prevent loss of the solvent (acetone) and/or entry of air should the cylinders cool considerably below the temperature at which they were discharged.

6. **Drying of Cylinders.** Cylinders used for aviators' breathing oxygen, dry oxygen, dry nitrogen, dry argon, dry helium, or dry air, which are found to have open valves and/or a positive internal pressure of less than 25 p. s. i. gage, should be tagged "Dry Before Refilling."

2049. SPECIFIC COMPRESSED GASES

1. **Acetylene.** See Chapter 10 for description of hazards and safety precautions.

2. **Carbon Dioxide.**

a. Carbon Dioxide is a dangerous asphyxiant because it is not detectable by ordor or by color when present in hazardous quantities. It is heavier than air and gives little if any warning to personnel exposed to it until they are completely overcome. The inhalation of carbon dioxide will produce various effects, depending on the length of time it is inhaled.

b. The treatment of exposed personnel consists of artificial resuscitation, administering oxygen, and keeping the patient warm and quiet.

c. Do not enter an area or compartment containing hazardous amounts of carbon dioxide without being equipped with a breathing mask and an independent supply of oxygen or a supplied-air respirator. If this is not practicable and the case is extremely urgent, enter only when equipped with lifelines and with assistants standing by outside the area or compartment. Stay time in the contaminated area should be restricted to a minimum.

3. **Chlorine**

a. Chlorine should be used only by experienced and properly trained personnel. Where chlorine is used, good ventilation should be maintained and exposed personnel should be furnished with gas mask approved for protection against chlorine.

b. Where necessary, the presence of chlorine may be detected by using a cloth wet with aqua ammonia. Ammonia in the presence of chlorine produces white fumes.

c. If it is necessary to immerse chloine cylinders in a bath of warm water to facilitate discharge, extreme care must be taken not to generate a dangerous pressure in the cylinders. Care should also be taken to maintain the temperature of the water below 130°F. in view of the low melting point of the fusible plugs. In no event should the cylinder valve be submerged nor more than 20 percent of the surface area of the cylinder be under water.

d. **Treatment When Exposed:**

(1) Call Medical Officer. If breathing is impaired or has ceased, start administering mouth-to-mouth resusitation immediately. Patient should be removed to open air or to a space where air is not contaminated. CAUTION: RESTORING THE PATIENT'S BREATHING IS THE MOST IMPORTANT DUTY OF THE RESCUE TEAM.

(2) Administer oxygen if available. This should be done under the supervision of persons qualified to administer.

(3) Keep patient warm and quiet; cover with blankets if available. Rest is essential. Place patient on back with head and chest elevated.

(4) Splashes of liquid chlorine or chlorinated water on skin may cause skin irritation or acid burns. Remove clothing immediately and wash the affected area with large amounts of water.

4. **Anhydrous Ammonia.** Ammonia is used principally as a refrigerant. Should it become necessary to withdraw ammonia from

MT-PWHD-005590

0008 1378
REDACTED
J-M 83

refrigerating systems into cylinders, care should be taken to avoid overcharging of such cylinders. Only empty ammonia cylinders should be used for this purpose, and in order to insure that they are empty, their valves should be open and the cylinder vented (in the open) for a few minutes. Prior to attaching the cylinders to systems which are to be emptied, they should be carefully weighed and the tare weights (empty weight) noted. The cylinders may then be connected to refrigeration systems for filling, but should be weighed from time to time while filling in order that not more than the appropriate weight (50 to 100 pounds) of gas be charged in the 50- or 100-pound cylinders. If any cylinder be accidentally overfilled, the excess gas should be discharged slowly into water, preferably in the open, where any escaping gas vents to atmosphere.

a. Labeling Empty Cylinders. When cylinders that are used to store ammonia withdrawn from refrigeration systems are later returned to supply depots for refilling, they should be tagged with the explanation that the cylinders were so used.

b. Treatment When Exposed

(1) Artificial respiration. Summon the medical officer promptly. If the patient is unconscious, apply artificial respiration.

(2) Eyes. If the eyes are affected, and the medical officer is not promptly available, hold the lids open and pour water or a 2 percent boric acid solution over the eyeballs and lids, washing thoroughly; then apply two drops of liquid petrolatum.

(3) Skin. If the skin is affected, strip the ammonia-saturated clothing from the patient. Wash affected areas with water, then paint burned surfaces with a saturated solution of picric acid; use boric acid near the eyes. Do not cover burns with clothing or dressings without the approval of the medical officer.

(4) Nose and throat. If the nose and throat are affected, irrigate and spray nostrils with a saline if available; if not, plain water is satisfactory. Encourage patient to drink large amounts of water.

(5) Breathing fumes. Ammonia gas is lighter than air. Therefore, in going to the rescue of one overcome by ammonia, keep as near to the deck or floor as possible; and if a gas mask is not available, keep a wet cloth or sponge over the mouth and nostrils.

5. Freon

a. Handling Cylinders. Freon is used as a refrigerant and cylinders containing this gas are subject to the same handling and refilling rules as are given for ammonia cylinders, except that standard Freon cylinders are of 10- and 50-pound capacity.

b. Treatment When Exposed.

(1) Goggles. Personnel with the duty of servicing refrigeration systems with Freon should be furnished with safety goggles to eliminate the possibility of liquid Freon coming in contact with the eyes and causing injury due to the freezing effect of the liquid.

(2) Artificial respiration. Should personnel be overcome due to lack of oxygen in working spaces because of high concentrations of Freon gas being present, such personnel should be given artificial respiration as in the case of suffocation.

6. Combustible Gases (Liquid Petroleum Gas, Hydrogen Methyl Chloride, Etc.). The same safety rules apply to combustible gases as are outlined for acetylene in Chapter 10, except that these gases are stable and no hazard is attached to their use at pressures above 15 p. s. i. gage.

7. Oxygen. See Chapter 10 for description of hazards and safety precautions.

SOLVENTS

2055. GENERAL

The variety of solvents used in compounds or formulations such as paints, adhesives, rubber and plastic materials, and in degreasing solutions pose a problem with respect to the possible hazards attendant to

1981

MT-PWHD-005591

0008 1273
REDACTED
J-M 83

their use. Under certain conditions all organic solvents are toxic in varying degrees and, with the exception of chlorinated solvents, they are flammable. Depending upon the extent and conditions of their use in any particular operation either independently or as principal ingredients in various mixtures, appropriate measures should be taken to minimize their toxic and flammable effects. Exposure of the skin to solvents can cause dermatitis and personnel involved in operations requiring frequent or prolonged contact with solvents should wear solvent resistant gloves. Organic solvents can be broadly classified according to their chemical structure:

Aliphatic hydrocarbons or petroleum type solvents of which Stoddard solvent and mineral spirits paint thinner are examples,

Aromatic hydrocarbons such as benzene and toluene,

Halogenated hydrocarbons which are usually chlorinated aliphatic hydrocarbons such as carbon tetrachloride and methyl chloroform,

Alcohols, methyl alcohol and ethyl alcohol being the principal solvents in this class,

Ketones such as acetone and methyl ethyl ketone, and

Esters which are represented principally by ethyl acetate and amyl acetate.

1. **Aliphatic Hydrocarbons.**

a. Stoddard Solvent. Stoddard solvent has a low order of toxicity and may in many instances be used as a general purpose solvent or cleaner or as a substitute for the more toxic chlorinated solvents. Although its flash point is above 100 °F., it is flammable and appropriate precautions should be taken to minimize the fire hazard. Standard stock *mineral spirits* paint thinner and *dry cleaning solvent* are similar to Stoddard solvent in fire and toxic properties.

b. Petroleum Naphtha. Petroleum (aliphatic) naphtha, sometimes called petroleum ether, also has a low order of toxicity but it is considerably more flammable than the Stoddard-type solvents, its flash point being 0 °F. or below.

2. **Aromatic Hydrocarbons**

a. Benzene. Benzene, also called benzol, is one of the most toxic solvents and is also quite flammable, having a flash point of 12°F. Because of its low threshold limit (25 p. p. m.), its acute narcotic and severe to fatal nervous system effects, and of its chronic effects (particularly aplastic anemia), benzene is classed as a poison and its use should be prohibited or at least severely restricted. Although benzene is being used less frequently as a solvent in proprietary compounds, the possibility of its use in rubber and plastic cements, paint removers, and in some lacquers or dopes shall be recognized. Other less toxic aromatic or chlorinated solvents can in most cases be used satisfactorily as substitutes for benzene.

b. Toluene and Xylene. Toluene (toluol) and xylene are classed as flammable liquids and their vapors are considered toxic. Any operations involving these solvents should be surveyed for possible health and fire hazards. Many types of paints, enamels, lacquers, and adhesives are likely to contain one or both of these compounds as thinners.

c. Aromatic Naphtha. Aromatic naphtha (V. M. & P or coal tar naphtha) contains a high proportion of aromatic hydrocarbons and, therefore, has toxicity and flammability properties comparable to the pure aromatics for which it is used as a substitute in many formulations.

3. **Halogenated Hydrocarbons.**

a. General. Solvents in this class are generally considered nonflammable. For this reason and also because of their high volatility and generally good solvent action on a variety of organic compounds, they are widely used for the removal of oil and grease, paint stripping, and general cleaning. Some are poisonous, all are toxic and are narcotic and anesthetic agents, producing deep anesthesia and even death under prolonged exposure to excessive concentrations. High intensity ultra-violet light and heat decompose chlorinated hydrocarbon vapors into highly toxic compounds such as phosgene (see 1039.1). The following precautions should be exercised in using chlorinated solvents:

1982

MT-PWHD-005592

REDACTED

J-M 83

LBNS SAFETY SUPPLEMENT NO. 2055

Subj: Hazardous Solvents

Ref: (a) NAVMAT P-5100, Article 2055

1. PURPOSE. To supplement reference (a) with additional instructions on hazardous solvents.

2. CONTROL. The Quality Assistance Office (Code 134) has been delegated the authority to control the use of hazardous solvents. Shipyard usage of all hazardous solvents shall be limited to minor quantities which will be stored in the chemical shop stores. Before acquiring solvents considered hazardous, approval must be obtained from the Quality Assurance Office (Code 134). Solvents presently controlled, requiring the authorized signatures of Code 134 or 134C are:

a. Carbon Tetrachloride
b. Benzene or benzol
c. Methyl alcohol or wood alcohol

3. CHLORINATED SOLVENTS. Chlorinated solvents (trychlorethylene, perchlorethylene, etc.) are used in the Shipyard principally in vapor-phase degreasers and in fuel oil heater cleaning. These solvents are considered moderately toxic and if inhaled, they may produce nausea, dizziness, headaches and/or general ill feeling. If they come in contact with the skin, the same effects as produced by inhalation may result, as well as skin damage. In order to provide maximum safety for personnel exposed to these solvents, the following precautions will be observed:

a. Chemical cartridge respirators will be worn by degreaser operators when working near or over degreaser tanks.

b. A chemical cartridge respirator will be in the possession of at least one member of the party operating circulating systems using chlorinated solvents for fuel oil heater cleaning, to be used in case of slight spillage.

c. If there is gross spillage, defined as exceeding one cup, the area will be regarded as untenable and access immediately denied all personnel. Shop 99 will be immediately requested to provide mechanical ventilation in the area and the Industrial Hygienist requested to test the area. Access to the area will be restored when the Industrial Hygienist determines that conditions are satisfactory for the resumption of the work.

MT-PWHD-005593

REDACTED
J-M 83

d. At no time should chlorinated solvents or their vapors be permitted to come in contact with the eyes, skin, or clothing. Rubber gloves, aprons, goggles, face shields, etc. shall be used as appropriate to prevent contact.

e. Adequate ventilation should be provide in the area of operation at all times. When additional ventilation is required, Shop 99 will be requested to provide necessary temporary ventilation.

4. CARBON TETRACHLORIDE FIRE EXTINGUISHERS shall not be used under any circumstances.

MT-PWHD-005594

0008 1276

REDACTED

J-M 83

(1) The use of comparatively large quantities of chlorinated solvents for cleaning up oil and grease on floors or in bilges should be prohibited. Less toxic high-flash aliphatic solvents or emulsifying-type cleaners, such as the standard stock tank and bilge cleaner (FSC 6850), should be used for gross oil and grease clean-up jobs.

(2) Sufficient forced ventilation to insure safe concentrations of solvent vapor in the workroom should be provided where regular chlorinated solvent processes (such as degreasers) are installed.

(3) Skin contact with chlorinated solvents should be avoided.

(4) Use of chlorinated solvents for fabric and upholstery cleaning shall be prohibited.

b. **Principal Halogenated Solvents.**

(1) Carbon tetrachloride. Carbon tetrachloride is one of the most toxic solvents. It has caused more deaths and injuries that any of the others. The Chief of Naval Operations has prohibited the use of carbon tetrachloride for any purpose, including fire fighting, unless specifically authorized by the cognizant bureau or office. It is important to note that the minimum concentration which can be detected by odor is about five times its threshold limit value (10 p. p. m.). A much less toxic solvent, (see below), can be substituted for carbon tetrachloride in most applications.

(2) Methyl Choroform (1, 1, 1 - trichloroethane). Although methyl chloroform is considerably less toxic than carbon tetrachloride and is usually prescribed as a substitute, it must be recognized that it is toxic and should be handled in accordance with the precautions generally applicable to chlorinated hydrocarbons (see article 2055.3a). Because of its corrosive action on metals, particularly on aluminum, most methyl chloroform formulations contain an inhibitor which in itself is flammable; therefore, after about 90 percent evaporation of the inhibited solvent, the residue contains a high percentage of flammable inhibitor.

(3) Trichloroethylene and Perchloroethylene. These solvents are moderately toxic and are used extensively in vapor-phase degreasers. The degreasers should be frequently inspected for effective operation of the ventilating system, safety thermostats, and temperature indicators.

(4) Chlorobenzene. Although not commonly used as a solvent, chlorobenzene is occasionally used as such and may be found in carbon removing formulations. It is quite toxic and, unlike most chlorinated hydrocarbons it is classed as a *flammable liquid.* Dichlorobenzene and trichlorobenzene are used in similar formulations, and their toxicities are comparable to that of the monosolvent but are somewhat less flammable.

4. **Alcohols.** As a class, alcohols are moderately toxic in the vapor state and possess only mild narcotic properties. All of those mentioned below are classed as flammable liquids and are therefore fire hazards.

a. **Methyl Alcohol.** Methyl alcohol (methanol or wood alcohol) is used as a general solvent and is found in some varnishes, lacquers, shellacs, and paint removers and also as a non-permanent anti-freeze water additive. Compared to the solvents previously mentioned, its vapors are not highly toxic. However, ingestion of methanol can be and has been fatal and for this reason it is rated as a poison. Because of the probability of mistakenly consuming methyl alcohol for the desired effects of ethyl alcohol, containers should be conspicuously marked with *Poison* labels.

b. **Ethyl Alcohol.** Ethyl alcohol (ethanol) is also used as a general solvent. The effects of ethanol ingestion are well known. Industrial ethanol is denatured to render it unpalatable. Its vapors are of a low order of toxicity the inhalation of which produce the same symptoms as those produced by ingestion.

c. **Butyl Alcohol.** Butyl alcohol (butanol) is used as a lacquer solvent. Its vapors are very irritating to the eye, even at concentrations below its threshold limit value, and are appreciably more toxic than the alcohols mentioned above, liver damage and blood changes being the possible health effects.

MT-PWHD-005595

0008 1277 REDACTED J-M 83

5. **Ketones.** The ketones are general purpose solvents for organic materials and are used as solvents in some paint, enamel, varnish, lacquer, and other organic coating formulations. Acetone, methyl ethyl ketone and methyl isobutyl ketone are the most widely used ketones. All are classed as flammable liquids, acetone being the most highly flammable of the group. Their vapors have fairly strong narcotic effects and are irritating to the respiratory tract.

6. **Esters.** As a class esters have a low order of toxicity but do produce narcosis and are irritating to the respiratory tract. The principal esters such as ethyl acetate, butyl acetate, and amyl acetate are used primarily as lacquer solvents. They are all classed as flammable liquids, ethyl acetate being the most flammable of the three.

PLASTICS

2056. GENERAL

Plastics in themselves generally pose no particular problems with respect to toxicity or flammability. However, the various compounds in which they are found, such as in coating, adhesive, and molding formulations contain other ingredients (solvents, accelerators, inhibitors, curing agents, etc.) which often introduce health and fire hazards. The presence of such hazardous materials in plastic formulations used in specific operations and procedures should be ascertained and appropriate preventive and precautionary measures taken to counteract the hazards involved. The following hazards are but representative of the more prevalent or common ones found in Navy industrial activities.

1. **Plastic Dusts.** Suspended dusts from certain powdered plastic formulations, particularly molding compounds, are explosive. Any operations involving such compounds where appreciable quantities of dust are created should be investigated for the existence of explosive conditions. For information on the explosibility of the dusts of various plastics and applicable precautions see National Fire Protection Association Standard for the Prevention of Dust Explosions in the Plastic Industry, NFPA No. 654.

2. **Epoxy Resins.** Epoxy resins are being used extensively in the form of paints, adhesives, plastic repair kits, caulking compounds, and concrete repair compounds. Use of these materials involves the mixing of two parts, one of which is an amine-type hardener or curing agent having severe irritating properties. It is very important that meticulous care be taken in the mixing and applying of epoxy materials to avoid contact with the skin:

a. Apply protective cream to exposed skin areas and to potentially exposed area even when protective clothing is worn.

b. Wear impervious gloves, sleeves, and aprons wherever feasible and faceshields if splash is likely.

c. Provide optimum ventilation. Permanent repair or layup facilities should include installation of an adequate ventilation system. Mixing should be done in the open or under an exhaust hood.

d. Immediately wash with soap and water any areas of the skin that have contacted the wet, uncured materials. Contaminated clothing should be removed at once. A daily change of clothing is advisable in full-time operations.

3. **Foamed Plastics.** Some of the numerous applications for foamed-in-place polyurethane plastics are filling voids, flotation chambers, thermal insulation and filling custom-built molds. Many such applications require that the operation be performed in confined spaces. The foaming agent, tolylene diisocyanate (TDI), is highly irritating even in very small atmospheric concentrations. Because of its strong irritating effect on the eyes and respiratory system, personnel are not likely to remain in comparatively high concentrations of TDI fumes. However, its odor is practically undetectable at its

1986

MT-PWHD-005596

0008 1278
REDACTED
L-M 83

LBNS SAFETY SUPPLEMENT NO. 2057.4

Subj: Lead Processing; Control of Health Hazards Involved in

Ref: (a) NAVMAT P-5100, Chapter 20, Article 2057.4

1. GENERAL

a. Lead in all forms, whether metal scrapings and dust, oxides from dross, or fumes of the heated metal, is harmful if absorbed in sufficient quantity by the body. Lead enters the body principally by two means: by swallowing lead dusts introduced into the mouth on food, tobacco, fingers, or other objects; and by inhaling dust and the fumes of the molten metal.

b. Very little lead fume is produced in the air at the melting temperature of lead, 621°F, or slightly above, but the vapor pressure of lead increases rapidly above 800°F to produce hazardous concentrations of lead fume in the air. In addition, there is a hazard from the dust of lead oxide, or dross, which forms on the surface of the metal and is dispersed mechanically or by the volatilization of fluxes.

c. Cleanliness of work areas and personal hygiene are of extreme importance when welding, cutting, melting or casting lead, lead alloys and lead coated metals. In order to perform this work without hazard to health, it is important that the temperature of the metal be prevented from reaching an excessive level, that adequate exhaust ventilation be provided, that personal cleanliness be encouraged, and that good housekeeping practices be employed to prevent the spread of dusts into the air or to other areas.

2. POLICY. To assure that environmental control measures and practices are adequate and that employees are not absorbing lead, the following will apply:

a. Each employee assigned to perform duties involving extensive lead processing will be given a medical examination prior to such work, at regular intervals not to exceed three months, and at termination of employment.

b. Lead dross, scrap and dust will be collected as soon as practicable and placed in containers for disposal to prevent the dust from becoming air-borne or from being walked upon and spread to other areas.

c. Each employee performing duties involving lead will wash hands and face before eating.

d. Eating or smoking will not be permitted in areas where lead work is performed.

MT-PWHD-005597

REDACTED
J-M 83

3. RESPONSIBILITIES

a. The Medical Officer is responsible for arranging medical examinations of all employees performing lead work when necessary.

b. Superintendents of shops where employees will be involved in lead work for extended periods or large amounts of lead are responsible for notifying the Medical Officer in advance when work is to be performed, and for providing each employee engaged in lead processing a copy of this Chapter for his information and guidance.

4. PERSONAL PROTECTIVE EQUIPMENT

a. Approved metal fume respirators will be used for operations involving the heating of lead or low-melting-point lead alloys, except when provided with ventilation or the work is done outdoors.

b. Filter-type respiratory protection approved for lead dusts will be worn for processes involving the generation of lead dust, as in grinding or buffing, except when provided with ventilation.

c. An air-supplied respirator or metal fume respirator will be worn for cutting of metals coated with lead or leadbearing paint.

5. VENTILATION

a. Lead welding or cutting. Local exhaust ventilation will be provided to remove the lead fumes at the point of formation. It will have a flexible duct with a hood using a 3-inch wide flange around the suction opening. The hood shall be placed as near as practicable to the work. The air flow shall be sufficient to maintain a velocity of 100 linear feet per minute at the source of contamination. The following table can be used as a guide to meet this condition:

Maximum Distance from Arc or Torch	Duct Diameter	Minimum Air Flow Cubic Feet/Per Minute
4 to 6 inches	3 inches	150
5 to 8 inches	3½ inches	275
8 to 10 inches	4½ inches	425
10 to 12 inches	5½ inches	600

The above is based on a duct velocity of 4000 linear feet per minute.

Care will be taken to assure that exhaust-ventilated air is discharged outside the shop and a safe distance (approximately 20 feet) from fresh air intakes or work areas.

b. Lead melting or casting. If the temperature of the melt is thermostatically regulated at less than 800°F, no control other than

1988

MT-PWHD-005598

good natural ventilation is required. Otherwise, mechanical exhaust ventilation to provide a control air movement of 100 feet per minute across the pot, or at all openings if enclosed by a hood, will be required.

REDACTED
J-M 83

MT-PWHD-005599

0008 1281

REDACTED
J-M 83

very low threshold limit value of 0.02 p.p.m. The following precautions should be followed in operations involving both the mixing and application of foamed-in-place plastics:

a. Provide local exhaust ventilation. At low concentrations of TDI, organic vapor-type respirators may be adequate provided all personnel within the influence of the fumes are afforded such protection.

b. Wear air-supplied respirators in confined spaces where adequate exhaust ventilation is not feasible.

c. Wear chemical goggles and impervious gloves and aprons where splash or contact with the skin is likely.

d. Provide adequate ventilation or respiratory protection when welding or other heating operations are likely to burn in-place foamed plastic material.

THE METALS AND THEIR COMPOUNDS

2057. GENERAL

Any operations involving toxic metals and their compounds which produce dusts, fumes, or mists are likely to introduce health hazards and appropriate measures should be taken to avoid the exposure of personnel to hazardous concentrations. Typical operations likely to contaminate the atmosphere are: paint spraying, grinding, sanding and buffing metals and coated surfaces, foundry heats, welding and heating coated surfaces, and electroplating. The following significantly toxic metals (and their compounds) are the ones most frequently found in industrial operations.

1. **Beryllium.** Beryllium and its compounds are highly toxic causing seriously chronic-to-fatal lung diseases and dermatitis. The concentration of beryllium particulate matter in air below which it is considered to be safe is so low (2 micrograms per cubic meter of air) that the safe working level is practically zero. Therefore, any operations involving beryllium and its alloys or compounds which are likely to generate dust or fumes must be meticulously controlled and frequently monitored. Depending on their magnitude and continuity, proper control of beryllium operations may require the use of exhaust hoods at the point of operation, meticulous housekeeping practices, daily change of special work clothing, daily showers, and special precautions in disposal of waste.

2. **Cadmium.** The fumes of cadmium and its compounds, particularly cadmium oxide, are highly toxic, producing serious-to-fatal results principally from lung damage. Cadmium readily vaporizes even at temperatures below its melting point, and at the melting point its high vapor pressure can generate fume concentrations more than 5000 times the threshold limit; therefore, relatively small amounts of molten cadmium can generate harmful fume concentrations. Since the metal is widely used as a protective coating on ferrous metals, particular precautions should be taken to protect personnel engaged in welding, burning, or any heating of such metals. Cadmium is also an ingredient in several brazing alloys which readily release highly toxic fumes at the required brazing temperatures.

3. **Chromium.** The toxic action of chromium is confined to its compounds. The harmful effects are primarily irritation and ulceration of nasal passages and of the skin. Personnel engaged in such operations as the spraying and sanding of chromium pigmented paints and chromium electroplating should be provided adequate respiratory and skin protection.

4. **Lead.** The toxicity of lead is well known and is one of the most important industrial hazards among the toxic metals. Its harmful effects are broad in scope, ranging from comparatively mild stomach upsets and blood changes to disabling and fatal damage

MT-PWHD-005600

0008 1282 REDACTED J-M 83

to the nervous system. The elemental metal is found in a variety of alloys, as a compound in paints and ceramics, and as tetraethyl lead in gasoline. The principal operations producing substantial health hazards are lead alloy pouring, spraying and sanding of lead pigmented paints, and flame cutting painted steel. Tetraethyl lead, being volatile at ordinary temperatures, poses a serious health hazard in the cleaning of leaded gasoline storage tanks (see 2020.3).

5. **Mercury.** Absorption of comparatively small amounts of mercury or its compounds by ingestion or inhalation can result in acute poisoning (kidney damage) which may be fatal. Chronic poisoning resulting from long exposure is usually manifested in damage to the nervous system or by mental disturbances. One of the principal hazards in Navy industrial activities with respect to mercury is involved in the filling of mercury manometers commonly used in measuring pressures and fluid flow in various equipments and processes. The careless handling of mercury in this operation many times results in accumulations of spilled mercury on table tops, floors, etc. such that hazardous mercury vapor concentrations may develop if the space is confined and ventilation is inadequate. See article 1708.2a for appropriate precautions and decontamination procedures.

6. **Zinc.** Although zinc fumes are not highly toxic and do not appear to produce chronic symptoms or cumulative effects, the common occurrences of the annoying and sometimes disabling transient effects is worthy of mention. The welding or torch cutting of galvanized steels and casting of brass and bronze occasionally result in the occurrence of metal-fume fever (fever and chills) and any such operations should be performed with adequate ventilation or suitable respiratory protection.

DUSTS

2058. MINERAL DUSTS

Certain mineral dusts are pneumoconiosis (a pathological lung condition produced by mineral or metallic dust inhalation) producing. The most prevalent and insidious forms are silicosis and asbestosis caused by prolonged inhalation of dusts (or mists) containing silica and asbestos.

1. **Silicosis.** Silicosis has long been recognized as an occupational disease in such industries as mining and quarrying. The damage done is permanent and progressive with continued exposure. In its more advanced stages, it is evidenced by shortness of breath, decreased chest expansion, lessened capacity for work, and increased susceptibility to tuberculosis and other lung diseases. Therefore, any operations which create appreciable quantities of silica (quartz, principally) such as in sand blasting should be well ventilated and, if necessary, personnel should wear appropriate respiratory protection.

2. **Asbestosis.** Over a number of years, the inhalation of excessive asbestos dust can result in a crippling respiratory condition termed asbestosis. The most significant exposure to asbestos dust occurs during the ripout or tearout of asbestos materials aboard ship. Exposures also result during the production and installation of asbestos containing materials. The following precautions are required for the safe handling of asbestos products:

a. General precautions:

(1) The Industrial Hygiene Division of the Medical Department shall evaluate the level of asbestos exposure and will recommend engineering control measures for dust controls and provide, at least twice yearly, indoctrination of insulation workers in measures of personal protection.

(2) Asbestos dust concentrations shall be controlled so as not to exceed the threshold limit value for asbestos as stated in the current BUMED INSTRUCTION 6260.3

MT-PWHD-005601

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J-M 83

NAVSHIPYDLBPACHINST 5100.27C

LBNS SAFETY SUPPLEMENT NO. 2058.2

Subj: Asbestos Exposure Hazards; Control of

Ref: (a) NAVMAT P-5100, Chapter 20, Article 2058.2
(b) NAVSHIPINST 5100.26 of 9 February 1971

1. PURPOSE. To establish policies and delineate departmental responsibilities regarding the controls and precautions required to assure that personnel are not exposed to excessive concentrations of airborne asbestos dust.

2. GENERAL

a. Asbestos is a broad term applied to a group of fibrous minerals such as amosite, chrysotile, crocidolite, etc., composed of silicates of iron, sodium, calcium and/or magnesia. Asbestos is found in the Shipyard and aboard ships in pipe insulation, lagging and the asbestos cloth used to cover pipe insulation and ventilation ducts. Exposures to asbestos by pipe covering and insulation workers, boilermakers and other trades occur during the production, installation and removal of asbestos materials in the shop or aboard ship. The inhalation of excessive asbestos dust over a number of years can result in a crippling respiratory condition termed asbestosis.

b. The exposure of personnel to airborne asbestos should be minimized by controlling airborne asbestos dust concentrations so as not to exceed a Threshold Limit Value (TLV) for airborne asbestos of 5 fibers larger than 5 micron per milliliter. (See reference (a)).

3. ACTION. The following safety precautions will be observed by all supervisors and workers engaged in the fabrication, installation, and/or removal of asbestos-containing insulation material.

a. Areas where the removal, fabrication, repair, and installation of dry asbestos materials is taking place are designated as "personnel exclusion" areas. These areas will be so posted and only personnel whose work requires their immediate presence shall be allowed access to designated exclusion areas.

b. It is mandatory that dust respirators available at Safety Issue be worn by all personnel, including ship's force, while present in a designated personnel exclusion area. When the respirator is not in use, the respirator will be protected in that it will not be subject to contamination.

MT-PWHD-005602

REDACTED
J-M 83

c. Signs used to designate personnel exclusion areas will be posted only when actual removal, fabrication repair and/or installation of dry asbestos material is taking place and removed upon the termination of such operations.

d. All insulation workers shall be provided with clean coveralls at the beginning of each shift when they will be working with asbestos. The coveralls will be buttoned to the neck. They will be removed before removal of the respirator and should not be beaten to remove excess dusts or scrap adhering to it. Contaminated coveralls will be placed in plastic bags, until disposed of or laundered. When coveralls become contaminated prior to the lunch break, the employee may be furnished new coveralls at the discretion of the employee's supervisor.

e. Whenever possible, industrial type vacuum cleaners should be used to pick up dusts and scrap. The vacuum cleaner operator will wear an approved respirator while operating the cleaner. Drop clothes will be placed under work tables or areas.

f. Suitable waste containers lined with disposable plastic bags will be provided at each cutting table/fabrication operation. Discarded and scrap asbestos materials will be immediately placed in plastic bags, which are then sealed for disposal. Scrap should be disposed of on a daily basis.

g. All asbestos-containing job materials will be carried to the job site in plastic containers.

h. As soon as practicable, all mixing will be done in plastic bags.

i. Asbestos cloth shall be wet down prior to fabrication and/or application.

j. Portable dust collectors/industrial-type vacuum cleaners should be placed in use at the point of operations within confined spaces.

k. An all-out effort will be made to substitute non-toxic products for asbestos whenever practicable.

4. RESPONSIBILITIES. In compliance with references (a) and (b), and to insure that personnel are not exposed to concentrations of airborne asbestos in excess of the Threshold Limit Value, the following departmental responsibilities will apply to all operations involving the removal, fabrication, repair, and installation of asbestos materials.

MT-PWHD-005603

REDACTED
J-M 83

a. NRMC Dispensary, Long Beach Naval Shipyard

(1) Shall conduct, with the assistance of Code 185, a semi-annual indoctrincation in measures of personnel protection for pipe-coverers and insulators and shipboard boilermakers.

(2) Shall review and approve the design and specifications of equipment proposed to control asbestos dust, such as vacuum cleaners and ventilation systems.

(3) Shall conduct an annual chest x-ray program for all pipe-coverers and insulators, including supervision and personnel who have been transferred and/or reassigned. These personnel are to be given a 14" x 17" x-ray annually. The x-ray films are to be specifically directed to the radiologist to alert him to the need for a special type of reporting. The health records of pipecoverers and insulators are to be marked "Asbestos Worker."

(4) Shall make periodic surveys of the areas where asbestos insulation is being processed to determine the level of asbestos dust. If the allowable Threshold Limit Value is exceeded, advise shop supervisors so that appropriate corrective action can be taken.

b. Planning Department (Code 230). Identifies work control documents involving the extensive removal and/or installation of pipe covering aboard ship by stating in the key operation for the work the statement "extensive pipe insulation work."

c. Public Works Department (Code 421.1). Forwards a copy of this instruction to the trash collection contractor so that contractor personnel can be advised of the safety precautions required for the disposal of asbestos scrap materials.

d. Administrative Department (Code 800). Includes a copy of this instruction in the "Information to Ships" (11ND-NSYLB-P5000/1), delivered to the ship's force at the start of the availability.

e. Production Department

(1) Code 380:

(a) Insures that all methods and standards that involve contact with asbestos, specify appropriate safety precautions from NAVMAT P-5100-2058 standards.

MT-PWHD-005604

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(b) Insures that all equipment and facilities used in processing asbestos comply with NAVMAT P-5100-2058 standards.

(2) Code 930:

(a) Insures all personnel involved with or exposed to asbestos work are indoctrinated in the hazards present in asbestos material.

(b) Insures that safety equipment, complying with NAVMAT P-5100-2058 standard, is provided to personnel exposed to asbestos hazards.

(c) Insures that all supervisory personnel responsible for asbestos work are fully aware of the safety precautions in NAVMAT P-5100-2058, and of their obligations to strictly enforce these rules.

MT-PWHD-005605

0008 1287

REDACTED
J-M 83

series titled "Threshold limit values for airborne toxic materials."

(3) Scrap material shall be wet down before shoveling, hauling or dumping.

(4) Discarded and scrapped asbestos materials shall immediately be placed in plastic bags which are then to be sealed for removal and disposal.

b. Fabrication in Shop.

(1) Shop walls, ceilings and floors shall be so designed to prevent dust accumulations and to facilitate housekeeping measures.

(2) Cutting benches shall be equipped with exhaust (down-draft or hood) ventilation.

(3) Asbestos cloth shall be moistened prior to cutting for pad fabrication and ralated production requirements.

(4) Local exhaust ventilation shall be installed on power saws and sewing machines. In addition, power saws shall be located within an enclosure provided with dilution and general exhaust ventilation. Exhaust ventilation ducts shall be connected to collectors (bag-house) for purpose of removing asbestos fibers.

(5) In-shop operations for mixing asbestos containing cements shall be accomplished with permanent exhaust ventilation equipment. In-bag mixing techniques are acceptable without the need for ventilation.

(6) Asbestos dust accumulations in insulation shops shall be avoided through scrupulous housekeeping measures. Dry sweeping methods are prohibited. It is recommended that industrial vacuum cleaners be used for daily cleanup after normal working hours. Vacuum cleaner operators shall wear dust respirators. If vacuum cleaning operations must be conducted during working hours, respirators shall be worn by all personnel exposed to the dust.

(7) All machines shall be furnished with suitable waste containers for the collection of scraps and waste to prevent the material from falling on the floors and generating dust.

c. Removal, Repair and Installation.

(1) It is mandatory that dust respirators approved by the Bureau of Mines be worn during ripout and repair operations.

(2) Personnel engaged in ripout operations will be provided and required to wear clean coveralls at the beginning of each shift. Prior to removing the dust respirator, used coveralls shall be removed. Clean or single-use coveralls shall be provided daily.

(3) Shipboard "ripout" of insulation shall be accomplished in designated exclusion areas. Only personnel whose work requires their presence shall be permitted in such areas. All personnel entering such areas shall be made aware of the hazards. Ships' force (crewmen) and others accomplishing essential duties in the removal area are required to wear approved respirators.

(4) The area in which removal takes place shall be confined by means of curtains, portable partitions, etc., to prevent excessive contamination of other areas.

(5) Portable mechanical exhaust ventilation should be used to remove airborne dust and exhausted into bags or suitable devices to collect the dust.

(6) Unpacking and application shall be accomplished in a manner that will minimize airborne dust.

(7) Hand sawing, cutting, jacket stripping, etc., shall be done in a manner that will create minimal airborne dust. Use of proper methods and tools will help considerably towards dust abatement.

(8) When working in confined spaces, portable dust collectors or exhaust blowers shall be provided to remove dust from the source. Dust will be collected in suitable collecting devices designed to prevent dispersal.

(9) Dust shall not be exhausted into other working areas.

MT-PWHD-005606

REDACTED
J-M 83

RADIOACTIVE MATERIALS

2059. GENERAL

The precautions applicable to the use and storage of hazardous radioactive materials are adequately covered by manuals and instructions issued by the commands, bureaus, and offices of the Navy Department. For reference purposes they are listed below according to subject matter:

1. **Basic Regulations.**

a. *Radiation Health Protection Manual* – NAVMED P-5055.

b. *Policy Coordination of Matters Dealing with Ionizing Radiation, Radioactivity, and Nuclear Materials* – SECNAVINST 5000.11 series.

2. **Radioactive By-Product Material.**

a. *Accountability of Radioactive By-Product Material and Radium* – NAVSHIPSINST 5100.19 series.

3. **Radiac Equipment.**

a. *Radiac Equipment Containing Sealed By-Product Material Sources at Supply or End-User Activities; Procedures for Control of* – NAVSHIPSINST 9673.14 series.

b. *Radioactive By-Product Material Used in Radiac Equipment Sealed Check Sources; Conditions Governing Use of* – NAVSHIPSINST 9673.19 series.

4. **Luminescent Material.**

a. *Control of Contamination from Radioactive Luminescent Material* – NAVSHIPSINST 5100.6 series.

b. *Hazards of Radioactive Luminescent Materials* – NAVSHIPSINST 5100.15 series.

5. **Miscellaneous**

a. *Radioactive Components of Target-Bearing Transmitters MK 8 and 9; Handling and Storage of* – NAVSUPINST 3400.2 series.

b. *Control and Disposition of Radioactive Equipment and Materials from Naval Nuclear Powered Ships* – NAVSHIPSINST 9890.12 series.

c. *Radioactivity in Water Supply and Waste Water Systems – Peacetime Detection and Control* – NAVFAC MO-218.

d. *Radiological Recovery of Fixed Military Installations* – NAVFAC TP-PL-13.

e. *Radiological Controls* – NAVSHIPS 389-0153.

f. *Nuclear Propulsion Plant Safety Manual* – NAVSHIPS 389-0197.

g. *Radiological Controls for Tenders and Submarine Bases* – NAVSHIPS 389-0266.

SPECIAL MATERIALS

2060. FIRE RESISTANT HYDRAULIC FLUID

The safety-type hydraulic fluid used primarily in shipboard hydraulic systems is comprised principally of a triaryl phosphate ester which is highly toxic and has a very low threshold limit value. Because of its very low vapor pressure, hazardous atmospheric concentrations of the fluid due to vaporization are unlikely at ordinary temperatures. However, under circumstances where mists or aerosols are generated or the fluid is at temperatures above 130°F., personnel should wear appropriate respiratory protective equipment. Contact with the skin should be avoided. Personnel constantly in contact with the fluid such as might occur in work on hydraulic systems or clean-up of spills should wear solvent resistant rubber gloves and also footwear, if necessary.

1. Gasoline Additive. Tricresyl phosphate is used as gasoline additive and as a pump lubricant in oxygen systems. It is available as a concentrate and in solvent dilutions. Tricresyl phosphate, being a triaryl phosphate ester, should be handled with the same precautions as those recommended above for safety-type hydraulic fluids.

1997

MT-PWHD-005607

NAVSHIPYDLBEACHINST 5100.27C

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LBNS SAFETY SUPPLEMENT NO. 2059.1

Subj: Radiological Safety

Ref: (a) NAVMAT P-5100, Chapter 20, Article 2059
(b) NAVSHIPYDLBEACHINST 5100.12F
(c) Joint NAVSHIPYDLBEACH/NSC Disaster Control Recovery Plan 1-64
(d) BUMEDINST 6470.10, 19 July 1971, Irradiacted or Radioactively Contaminated Personnel, Initial Management of
(e) NAVELEXINST 5100.1, 1 July 1968, Radioluminescent Materials, Hazards of
(f) NAVSUPINST 5101.6B, 5 July 1972, Items Containing Radioactive By-Product Material, Procedures for Requisitioning, Labeling, Handling Storage and Disposal of
(g) COMELEVENINST 4555.1, 3 July 1963, Radioactive Waste Disposal
(h) NAVSHIPSNOTE 9890, Ser OSR-214, 10 Feb 1971, Nuclear Propulsion Program, Radioactive Equipment and Materials Associated with Nuclear Propulsion Plants
(i) SPCCINST 5101.6A, 6 Aug 1969, Items under Cog of SPCC which contain AEC Licensed Radioactive Material, Procedures for Handling
(j) ESOINST 5100.3, 1 June 1965, Hazardous Materials under the Cognizance of USN Electronics Supply Office (Part I Radioactive Materials)

1. PURPOSE: To expand reference (a) to include additional references and instructions which are pertinent to the usage, storage, transportation/handling, and disposal of radioactive material. Additionally, information is referenced herein to eliminate unsafe conditions and minimize damage to personnel and equipment from radiation emitted from X-ray equipment and radioactive materials.

2. GENERAL: Ionizing radiations are radiations emitted from X-ray producing machines and radioactive materials. These include X-rays, gamma rays, alpha particles, beta particles, and neutrons. Ionizing radiations present both external or internal hazards to exposed personnel, the latter occurring when radioactive material is ingested, inhaled, or enters the body through broken skin. Employees exposed to radiation are subject to regulations which require the keeping of medical records, pre-employment examinations with special emphasis upon previous exposures, skin, eyes, blood counts, yearly physical check-ups, and final examination upon termination of exposure. In case of over-exposure immediate medical attention, close follow-up for a prolonged period of time, and temporary removal from further

MT-PWHD-005608

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J-M 83

exposure are indicated. Paragraph 6 below describes those areas in the Shipyard where radioactive materials are used or stored and/or where ionizing radiation from X-ray equipment and radioactive materials may occur.

3. SCOPE OF THESE REGULATIONS: The radiological safety regulations included in this supplement are intended for peacetime use by the Long Beach Naval Shipyard in laboratory and industrial operations. They are not and shall not be construed as applicable to atomic defense procedures.

4. PRECAUTIONS: In addition to those precautions, requirements, and responsibilities heretofore outlined by the reference documents in connection with circumstances involving exposure to ionizing radiation, the following general regulations shall apply:

(a) All personnel who are to be engaged in working with or near any radioactive substance shall receive proper instructions from supervisors thoroughly familiar with the hazard to insure their complete safety. Where Shipyard personnel are to work on nuclear propulsion type ships, special instruction shall be given to those persons by the ship's nuclear (engineering) officer and/or qualified Shipyard personnel.

(b) Personnel engaged in the using or handling of radioactive material shall carry on their person continuously while on duty, a film badge for the purpose of routine checking on the amount of radiation to which they have been subjected. These film badges will be collected and checked by the Industrial Hygiene Division at prescribed intervals.

(c) In addition to a film badge, personnel working, or passing in and out of a radiation area shall be required to carry on their person a pocket ionization chamber effective up to 200 milliroentgens. Where higher levels of radiation are suspected, radiation levels shall be monitored/measured by radiac instruments. Measurements will be recorded daily in a log located in, or convenient to the radiation area.

(d) An individual receiving or suspected of receiving external radiation greater than 25 roentgens in a single exposure must immediately report to the Dispensary.

(e) The recommended maximum permissible levels of contamination leaving an area is as follows:*

*Note: Subject to further decontamination in a non-contaminated area

MT-PWHD-005609

REDACTED
J-M 83

to insure compliance with the following requirements (NAVMED P5055): i.e. that any loose radioactive surface contamination does not exceed 450 micro-micro curies of Beta/Gamma activity or 50 micro-micro curies for Alpha activity as measured on a dry filter paper wiped over an area of 100 square centimeters.

	GAMMA	BETA	ALPHA
Vehicles			
0.7 Rem	X	X	
1000 Cpm			X (fixed)
400 Cpm			X (removable by swipe)
Personnel (including underclothing)			
1 m Rem/hr	X		
1000 Cpm			X
Anticontamination Clothing (including outer clothing and shoes)			
7 m Rem/hr	X	X	
1000 Cpm			X
Equipment			
7 m Rem/hr	X		
1000 Cpm			X (fixed)
400 Cpm			X (removable)
Respiratory Protective Devices			
1 m Rem/hr	X	X	
200 Cpm			X

(f) The definitions for levels of contaminated areas are as follows:

(1) An unrestricted area is an area in which the radiation level is not more than 2 milliroentgen/hour (2 m R/hr).

MT-PWHD-005610

REDACTED

J-M 83

(2) A Radiation Area is an area where a person could receive a dose of 5 m R/hr or 100 m R/5 day week.

(3) A High Radiation Area is an area where a person could receive a dose of greater than 100 m R/hr.

5. ON THE JOB SAFETY: The following general rules shall apply to all areas where radioactive materials are used and/or stored:

(a) There shall be a continuous and rigid adherence to all safety rules by all workers.

(b) Working conditions themselves must be safe and must encourage cooperation.

(c) Neat and orderly housekeeping must be carried on at all times.

(d) No extraneous objects shall be permitted on the work table.

(e) All equipment shall be kept in a neat and clean condition at all times.

(f) All equipment shall be left clean at the end of each working period.

(g) Personally owned tools and other equipment shall not be used in radioactive areas.

(h) No smoking or edible materials, including candy, chewing gum, or beverages will be permitted where radioactive materials are used or stored, or in a contaminated area.

(i) Protective clothing and respiratory protective devices will be worn in areas where radioactive materials are used/stored, or in a contaminated area, as specified by the Industrial Hygienist and/or the Safety Superintendent.

(j) The Industrial Hygienist and/or the Safety Superintendent shall both verify and authenticate various types of operating and working conditions to prevent Shipyard personnel from receiving radiation exposure in excess of permissible values. The Industrial Hygienist shall maintain a list of personnel cleared for exposure to ionizing radiation.

6. SPECIAL PRECAUTIONS FOR SPECIFIED AREAS:

(a) Radiographic Testing: It is directed that the procedures and practices that are contained in reference (b) be strictly observed in all work connected with radiographic testing of metals.

2001

MT-PWHD-005611

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(b) Calibration/Repair of Radiac Equipment: It is directed that all procedures and practices that are contained in reference (b) be strictly observed in all work concerned with the calibration and repair of radiac equipment and the use of radioactive sources.

(c) Use of X-Ray Equipment: No person shall remain in confined spaces or compartments when a X-ray machine is being used to make radiographic exposures. Precautions shall be taken to guard against the approach of any person to the immediate space and also to the next space immediately in line with the X-ray beam. Personnel engaged in the use of X-ray equipment shall carry film badges and pocket dosimeters as prescribed by the Industrial Hygienist, Code 725.

(d) Dust Hazards: Before a dust producing operation is begun involving radioactive materials, it must be determined that no injury to persons nor contamination of property will or can result. The Safety Superintendent and the Industrial Hygienist shall be notified, and permission obtained prior to the commencement of such type operation.

(e) Disposal of Miscellaneous Radioactive Waste Material (R.W.M.):

(1) The following provides procedures for the temporary predisposal storage of miscellaneous radioactive waste materials. These radioactive waste materials, which do not require licensing by the AEC, are used by the Naval shore activities and the Fleet in various devices/equipment such as: certain electron tubes, radium treated indicators of navigational instruments, the hands and dials of timepieces, thermostat dials, gas and smoke detectors, static elimination devices, lock illuminators, wrist depth gages. target bearing transmitters, luminescent markers, radiac instruments, and wipe/swipe test samples.

(2) When miscellaneous radioactive waste material, (r.w.m.) such as noted above, is to be received for predisposal storage, the following procedure shall be effected under the cognizance of Code 130: the submitter is to provide documentation which shall inform as to the origin of the r.w.m., the reason for disposal, approximate quantity/size/weight/number of units, and type isotope if possible.

(3) When radiac equipment is to be stored for predisposal, the type/model, part/subassembly, identification, serial number, type isotope, submitter, and transaction date shall be identified and all this information recorded.

(4) The predisposal storage area shall be monitored to ensure that the accumulation of radioactive waste material does not build up to a level exceeding 2.0 m R/hr as measured at the perimeter of the storage area fencing.

MT-PWHD-005612

REDACTED
J-M 83

(5) Disposal of radioactive waste materials shall be in accordance with AEC regulations as found in Code of Federal Regulations, Title 10. Atomic Energy, Part 20, and NAVSUPINST 5101.9 of 8 June 1973.

(f) Nuclear Ships: Material, equipment, instruments from nuclear propelled ships, which require repairs, modification and/or calibration, shall first be certified as being within permissible contamination levels by the ship's authorized representative. The certifying document shall accompany the repair, alteration, modification or calibration request, and shall be reviewed by the Planning Officer or his designated representative prior to the receipt of such materials, equipment, or instruments, or work performed. Where doubtful or borderline situations arise, the Industrial Hygienist and the Safety Superintendent shall be consulted. In such cases, the Radiac Facility may be used to confirm radiation levels of the material or samples, or for monitoring purposes.

MT-PWHD-005613

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J-M 83

WORK IN CONFINED SPACES

2070. DEFINITION OF TERMS

1. "Closed Compartments" or "Poorly Ventilated Spaces", are any spaces that are not well ventilated, or which have been closed for any appreciable length of time. Unventilated storerooms, blisters, double bottom tanks, cofferdams, pontoons, voids, idle furnaces, cold boilers, etc., are typical. The term includes spaces which are normally occupied or regularly used, but which have been vacated and sealed because of damage, or for some other unusual reason.

2. "Hot Work", is work involving welding, flame cutting, the use of open-flame equipment, or any work involving heating metal to or above a red heat. Riveting and any cold work involving the probability of striking sparks shall be considered as hot work, except when, in the opinion of the gas-free tester, circumstances do not necessitate such a classification. The precautions applicable to hot work shall apply to all other sources of flames, sparks, or intense heat, such as lighted cigarettes, open flame or electric cooking apparatus, nonexplosive-proof lights, electric motors, etc.

2071. CERTIFICATION OF CLOSED COMPARTMENTS

1. **Entry into Closed or Poorly Ventilated Spaces.** No person shall enter any closed compartment or poorly ventilated space in any naval unit unless and until a "gas-free" certificate has been issued by the safety engineer or his authorized representative to certify that the danger of poisoning or suffocation of personnel, or the danger of ignition or explosion of flammable gases has been eliminated or reduced to the lowest practical minimum.

2. **Entry in Emergencies.** In case of emergency, when it is necessary to send a man into a compartment or tank not certified as being gas-free or as containing sufficient oxygen, the man shall be equipped with an air-line mask or an oxygen rescue breathing apparatus. A line shall be securely fastened to him, the line being held by attendants outside who shall be prepared to haul him out if necessary. The men should use great care to see that this line does not become fouled. When using the air-line mask, the hose shall be attached to a source of air fit for breathing (*not* to an oxygen cylinder), and a slight positive pressure shall be maintained in the hose and face piece.

3. **Hot Work in Way of Explosives or Flammables.** No job involving hot work in the way of flammable or explosive materials shall be undertaken until the gas-free tester or his authorized representative has:

a. indicated which precautionary measures are appropriate to make the space safe;

b. certified that applicable directions have been complied with so that men can work in the area without danger of poisoning or suffocation, and that hot work can be undertaken without danger of fire or explosion.

4. **Watch.** No person shall perform work in any closed or poorly ventilated space, even though it is certified gas-free, without a watch posted outside. One watch may serve up to three such nearby spaces.

2072. GAS-FREE ENGINEER

1. **Qualification.** The gas-free engineer is a person qualified by training and experience to analyze hazardous conditions, especially with respect to entry into closed compartments and who has been authorized to decide in specific instances which precautionary measures shall be taken to safeguard personnel.

2. **Responsibilities.**

a. He shall post a suitable label or tag near the entrance to the space or in some conspicuous location, describing the condition of the space; or

b. He shall remain on the scene of operations until normal or safe conditions are restored.

MT-PWHD-005614

0008 1296 REDACTED J-M 83

c. He in turn may train and authorize competent persons to make preliminary inspections, gas tests, etc.

d. The gas-free engineer or his authorized representatives shall have authority to order men out of compartments or to suspend work whenever an unsafe condition is found to exist. However, he shall immediately notify the supervisor or other responsible authority of any such cessation of work and of the reasons therefor.

3. **Limitation of Authority.** When dictated by very urgent service requirements, the authority of the gas-free engineer may be relaxed as necessary but only with the approval of the supervisor. Under such circumstances, and if it is practical to do so, the gas-free engineer shall be consulted as to the safest practical alternatives, and his recommendations shall be followed insofar as the circumstances permit.

4. **Information on Labels.** Every certificate, label, or tag issued by the gas-free engineer shall give complete information regarding the compartment or space to which it applies, and the date and time it was issued. If it shows a SAFE designation, it shall also show the date and time after which the safe condition cannot be depended upon to exist and the safe notation will not be valid. To minimize confusion and misunderstandings, the limitations and applicability of the safety notations as well as their definitions are given in the following articles. These definitions are not intended to indicate which conditions must be attained or whether to clean, gas-free, inert with gas, blanket with steam, or press up the space.

2073. SAFETY NOTATIONS

1. **Colored Labels.** In connection with the requirements herein that the safety classification be shown on a tag hung outside a space, it is suggested that such tags be printed in various colors. It is suggested that red be used for "NOT safe for men – NOT safe for hot work" and green for "SAFE for men – SAFE for hot work." For all others, yellow is considered appropriate.

2. **Not Safe for Men – Not Safe for Hot Work.** To be used when the following conditions have been found to exist:

a. Personnel are in danger of poisoning due to hydrocarbon or other gases in excess of the limits of toxicity either present or likely to be evolved under prevailing conditions; or they are in danger of suffocation due to oxygen deficiency.

b. There is danger of work or explosion in the presence of hot work due to the existence of: concentrations of flammable vapors within the limits of flammability; the presence of residues likely to evolve dangerous amounts of flammable gases or vapors under the conditions prevailing; the presence of flammable or explosive materials which are likely to be affected by the hot work; or due to the fact that the surrounding spaces have *not* been protected as required.

3. **Safe for Men – Not Safe for Hot Work.** To be used when the following conditions have been found to exist:

a. Hydrocarbon or other gases in excess of the limits of toxicity are *not* present and are not likely to be evolved by the entry of workmen or by prevailing atmospheric conditions and the oxygen content of the air is sufficient for workmen.

b. There is danger of harm to workmen or of fire or explosion in the presence of hot work, due to the existence of one or more of the same conditions stated in 2.b above.

4. **Safe for Men – Safe for Hot Work.** To be used when the following conditions have been found to exist:

a. Toxic gases or vapors in excess of the limits of toxicity are *not* present, and are not likely to be evolved under *any working conditions* likely to prevail and the oxygen content of the air is sufficient for workmen.

b. Flammable or explosive materials or vapors have been removed, or adequately protected and surrounding spaces have been protected as required.

5. **Inerted – Not Safe for Men Inside – Safe for Men and Hot Work Outside.** To be

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J-M 83

NAVSHIPYDLBEACHINST 5100.27C

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LBNS SAFETY SUPPLEMENT NO. 2071

Subj: Opening and Closing of Tanks and Confined Spaces Aboard Ships

Ref: (a) NAVMAT P-5100, Article 2071
(b) U. S. Navy Regulations (1948), Article 0790
(c) LBNS Safety Supplement No. 2072

1. PURPOSE. To supplement reference (a) with procedures for opening and closing of tanks and confined spaces aboard ships.

2. BACKGROUND

a. The final responsibility for the safety of a Naval ship in commission is held by the ship's commanding officer, as specified in reference (b). However, reference (b) also assigns the Commanders of Naval Shipyards the responsibility for providing the ship's commanding officer with the necessary services as requested, to permit him to carry out his responsibility during a shipyard availability.

b. During an availability period, ship's force and shipyard personnel may both be assigned work items in the same space. This notice provides procedures to insure the safety of shipyard personnel and the ship when spaces are to be opened by shipyard personnel.

3. DEFINITIONS. For the purpose of this supplement, tanks and confined spaces will include:

a. Any confined space aboard ships with limited access.

b. Closed compartments or poorly ventilated spaces, including spaces that have been closed for a length of time.

c. Spaces that have been vacated and sealed because of damage, spillage of toxic or flammable materials, inactivation or other reasons.

4. RESPONSIBILITIES

a. Planning Department (Work Specifications Division) will issue Work Control Documents (Form 11ND-NSYLB-4851/100) to provide gas free engineering and cleaning services as required to insure areas are safe for entry and work, in accordance with reference (c).

b. The ship's safety officer will serve as the ship's commanding officer for approving the opening and closing of spaces for ships not in commission and Shipyard service craft.

MT-PWHD-005616

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J-M 83

c. All Shipyard Departments/Shops requiring opening or closing of tanks or confined spaces will:

(1) Obtain permission from the ship's commanding officer, or his delegated representative, to open the space.

(2) Insure that lighting, safety rails, and other safety devices as required are at the scene and installed upon opening the space.

(3) Request the services of Shop 11 (Pneumatic Tool Operator) to open the space.

(4) Arrange for gas free engineering services from Code 134 in accordance with reference (c).

(5) Arrange with Code 972 for cleaning service as required by the Gas Free Engineer to certify the area safe for entry and productive work.

(6) Insure that the gas free inspection procedures as required by reference (c) are complied with before entering the course of productive work.

(7) Upon completion of work, remove all material, pipe blanks, lighting, safety devices, debris, etc., from the space.

(8) Request permission from ship's commanding officer, or his delegated representative to close the space.

(9) Request Shop 11 (Pneumatic Tool Operators) to close the space.

(10) After Shop 11 has closed the space, notify the ship's commanding officer or his delegated representative that the work is completed.

5. FORMS. Work Control Document (11ND-NSYLB-4851/100) is available from Work Specifications Division (Code 229).

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NAVSHIPYDLBEACHINST 5100.27C

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J-M 83

LBNS SAFETY SUPPLEMENT NO. 2072

Subj: Gas Free Engineering

Ref: (a) NAVMAT P-5100, Article 2072

1. GENERAL. Severe explosions and fires may result if welding, cutting, or other hot work is done in spaces and compartments that are not entirely free of combustible solids, liquids, vapors, dusts or gases. In addition, the danger of poisoning or suffocation of personnel can occur in closed or poorly ventilated spaces. In order to eliminate or minimize these types of hazards, no person shall enter any closed compartment or poorly ventilated space aboard any naval ship unless and until a "gas free" certificate has been issued by the Gas Free Engineer or his authorized representative, which specifies that it is safe and that the danger of ignition of flammable gases and the danger of toxicity is not present or has been eliminated or reduced to the lowest practical level and the compartment or space has been adequately ventilated.

2. APPOINTMENTS OF GAS FREE ENGINEERING PERSONNEL

a. The Gas Free Engineer, Code 134, is organizationally located in the Laboratory Division of the Quality Assurance Office. He is responsible for the technical adequacy of all aspects of gas free engineering services at Long Beach Naval Shipyard. He may be reached on telephone extensions 6541 or 6542.

b. The Deputy Gas Free Engineer, Code 134B, is organizationally located in the Laboratory Division of the Quality Assurance Office. He is the authorized representative of the Gas Free Engineer, Code 134, and is responsible for all gas free operations as assigned by the Gas Free Engineer. The Deputy Gas Free Engineer assumes all duties and responsibilities of the Gas Free Engineer during his absence. He may also be reached on telephone extensions 6541 and 6542.

c. Gas Free Monitors are authorized representatives of the Gas Free Engineer. Gas Free Monitors are responsible for conducting inspections of closed compartments or poorly ventilated spaces including all tanks, cofferdams, voids, bilges, etc., in accordance with procedures furnished by the Gas Free Engineer. Gas Free Monitors may be reached on telephone extensions 6541 or 6542 and as shown in paragraph 5 below.

3. POLICY/PROCEDURE

a. No person shall enter any closed compartment or poorly ventilated space aboard a naval ship, including tanks, cofferdams, voids, bilges, etc., unless the Gas Free Engineer or his authorized representative has indicated that the danger of toxicity or suffocation

MT-PWHD-005618

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J-M 83

and ignition of flammable gases is not present or has been eliminated or reduced to the lowest practical level and the compartment or space has been adequately ventilated.

b. Prior to start of any work in any area aboard ship involving the possibility of gaseous conditions which could lead to danger of explosion or fire and/or danger of poisoning or suffocation of personnel, the supervisor in charge of work to be accomplished will request services of the Gas Free Monitors.

c. No job involving hot work on or in tanks, compartments, or closed spaces will be done aboard any ship unless the Gas Free Engineer or his authorized representative has inspected the place where the job is to be done, including all areas adjacent to or affected by the hot work, and has indicated that men can work in the area without danger of toxic atmosphere or suffocation and that the hot work can be undertaken without danger of fire or explosion.

d. The results of every gas free inspection will be recorded on a "gas detection" report and a colored tag. Two copies of the report will be given to the ship's officer-of-the-deck. One of these will be retained for the ship's file and the other will be picked up by the shop performing the hot work prior to commencing with the job. The tag will be affixed to the entrance of the area to which it applies or in the case of piping it will be affixed to the piping in the most conspicuous location. The report and tag will show the area to which it applies, the date and time it was issued and if it shows a SAFE condition (Green Tag), it shall show the date and time after which the safe condition cannot be depended upon to exist and the safe notation no longer valid.

e. SAFE conditions denoted by a green tag are subject to change prior to the expiration date and time specified on the "gas detection" report and associated tag whenever the environment of the designated space has been changed since issuance of the SAFE condition tag and report. Whenever this occurs or is suspected of having occurred, the space shall be immediately vacated and the gas free engineer notified.

f. No container for combustible solids, liquids, vapors, dusts or gases should be presumed to be clean or safe until proven so by the Gas Free Engineer or his authorized representative.

g. No work will be done on piping likely to contain flammable or toxic liquids or gases--including intake, discharge, distribution, service, heating, displacement, smothering and vent piping systems, ladders, grabs, etc., made of tubing in bulk tanks--unless it is specified on the job order and the piping has been inspected by the Gas Free Engineer or his authorized representative and has indicated

MT-PWHD-005619

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L-M 83

that the danger of ignition of flammable gases or danger of toxicity or suffocation is not present or has been eliminated or reduced to the lowest practical level.

h. All personnel working aboard ship who are likely to work in or enter closed or poorly ventilated spaces, or work on piping likely to contain flammable or toxic liquids or gases shall become thoroughly familiar with and understand the significance of each color type tag and "gas detection" report--certification tags are discussed in paragraph 6 below.

4. RESPONSIBILITIES

a. Quality Assurance Office will:

(1) Through the Gas Free Engineer and/or his deputy, act as consultant to the Shipyard and other naval facilities in the area on questions of flammability or explosibility of atmospheres or gases in cases not covered by instructions and, in conjunction with the Industrial Hygienist, serve as consultant on questions of toxicity of atmospheres.

(2) Order men out of compartments or spaces immediately or suspend work whenever an unsafe gaseous condition is found to exist therein. Immediately notify the cognizant type desk, ship superintendent and shop heads of any such cessation of work and the reasons thereof. The Gas Free Engineer or his deputy and the Industrial Hygienist as required will then determine the procedure to follow in order to restore the unsafe area to a safe area.

(3) Review and approve all internal directives affecting gas free operations; i.e., Approved Practice Sheets, Shipyard Instructions, and Departmental Instructions.

(4) Provide gas free test services when requested by cognizant shop and as authorized by job order.

(5) Develop gas free test procedures in accordance with Section XV, Chapter 9920 of NAVSHIPS Technical Manual.

(6) Train Personnel assigned to gas free monitoring.

(7) Establish audit plans for checking effectiveness of tests and equipment on a scheduled basis.

(8) Maintain a file record (gas detection reports) of all gas free tests conducted and furnish two copies to the ship's officer-of-

MT-PWHD-005620

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J-M 83

the deck. One copy is to be retained by the ship and the other to be picked up by the shop responsible for obtaining clearance for hot work.

(9) Borrow one man from the lead production shop to stand safety watch for Gas Free Monitor when only one monitor is available and working in tanks and/or similar spaces alone.

(10) When ventilation is not required for a space to be safe for men, the words "with ventilation" appearing on the yellow and green tag and on the "gas detection" report should be deleted by the gas free monitor.

(11) Consult with the Industrial Hygienist as required in matters dealing with toxicity of atmosphere.

b. Planning Department will:

(1) Arrange, by message, with ship's Commanding Officer prior to ship's arrival, for removal of gasoline from tanks scheduled for work in the Shipyard. The message should direct the ship's Commanding Officer to remove as much of the gasoline from tanks as is practical and the remaining space to be treated in accordance with instructions given to ship's force on page 3 of LBNS 940/1B Approved Practice Sheet 940/1B of 5 November 1968. The message should also direct the ship's Commanding Officer, prior to ship's arrival in the Shipyard, to remove all fuels from tanks (including gasoline) and flush fuel tanks and piping which is scheduled for work. Confirmation that the foregoing requirements will be satisfied will be obtained from the ship's Commanding Officer prior to the ship's arrival in the Shipyard.

(2) Ascertain in advance of work the nature of work to be performed and contents of closed compartments known to contain, or suspected of containing, toxic or explosive atmospheres. This includes fuel tanks and adjacent closed compartments and compartments with containers of fuel or gases, foods, chemicals and drugs.

(3) Issue job orders to Quality Assurance Office (Shop 35, Work Center 02) for all gas-freeing operations to be conducted aboard ships entering the Shipyard and periodically thereafter as required.

(4) Specify on job orders that any piping, valves, pumps, etc., likely to contain flammable liquids (intake, discharge, distribution and service systems, heating displacement, smothering and vent systems, ladders, grabs, etc., made of tubing in bulk tanks) to be worked in or on will be disconnected and blanked off, cleaned and gas-freed or inerted, when required.

(5) Arrange for receipt of written reports from the ship's Commanding Officer concerning preparations performed by the ship's force, such as fumigation, CO_2 blankets in cofferdams, or similar conditions which affect the safety of atmosphere in closed compartments.

(6) Furnish the Gas Free Engineer and ship superintendent with above information (paragraph (5)) and any additional technical information required as soon as possible prior to commencement of ship's work.

c. Production Department

(1) Shop Supervisors responsible for assigning personnel to work in tanks, cofferdams, voids, bilges and other similar spaces will:

(a) Prevent personnel from opening and entering closed compartments unless gas free clearance has been received from the Gas Free Engineer or his authorized representative. (See paragraph (2) below for one type of gas free clearance and paragraph (6) for gas free certification in general.)

(b) Prevent "hot work" (welding, cutting, drilling, grinding, riveting, chipping, etc.) on bulkheads or decks forming the interior or exterior part of a closed compartment, or adjacent surfaces to closed compartments, unless proper clearance has been received. This clearance will be obtained from the officer-of-the-deck of the ship, and the Gas Free Monitor separately, in each instance, prior to beginning. Clearance to perform hot work will come from the ship's officer-of-the-deck in form of his approval to proceed with the hot work. Clearance to perform hot work will come from the Gas Free Monitor in form of an updated green tag (see definition in paragraph 6) affixed to the tank/compartment and an updated Gas Detection Report, Form 11ND-NSYLB-10330/3 to be picked up from the ship's officer-of-the-deck.

(c) Insure that welding or cutting on or in a container that held combustibles be done only after clearance is obtained from Gas Free Monitor and with experienced welders or cutters under the direct supervision of persons familiar with the characteristics of such combustibles.

(d) Request gas free tests in accordance with paragraph 5 below when required or when in doubt and specify the location of the area to be tested.

(e) Carry out instructions of the Gas Free Monitor pertaining to stoppage of work or ordering workmen out of compartments.

MT-PWHD-005622

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J-M 83

(f) Assure that fire watches are present in accordance with current safety practices.

(g) Insure that unventilated spaces are properly ventilated at all times when personnel are assigned to work therein.

(h) Insure that workmen are provided with proper protective clothing and safety equipment.

(i) Insure that no work on piping systems, indicated in paragraph 4b(4), be conducted without being specified on the job order and only after having been inspected and certified as safe by the Gas Free Monitor.

(j) Become thoroughly familiar with the significance of each color and type of tag used to denote the conditions or results of the gas free test as shown herein (See Para. 6). Additionally, familiarize each person assigned to him with the procedure for obtaining clearance to enter tanks and other closed spaces.

(k) Take every precaution to assure that all conditions which assure the safety of men and hot work are in fact in accordance with this instruction and Chapter 9920 of NAVSHIPS Technical Manual (NAVSHIPS 0901-920-0003).

(l) Take every precaution to assure that any work in one area will not result in atmospheric pollution of adjacent areas or the area in which the work is being accomplished unless such areas are properly monitored and/or controlled. The supervisor at the job site in the shop performing the work will request gas free services prior to start of any work involving the possibility of pollution of spaces previously considered safe for men or hot work.

(2) Service Group will:

(a) Notify the Gas Free Monitor as soon as possible of any requests for gas free services telephoned by requesting shops to the Service Group Security Watch (see paragraph 5 of this supplement).

(b) Provide one standby, upon request, to stand by accesses to tanks, voids, etc., as a safety watch for Gas Free Monitor performing work alone.

(c) Provide suitable ventilation to all spaces (tanks/compartments) which are not properly ventilated and in which personnel are expected to perform work.

(3) Ship Repair Division - Ship Superintendent will:

(a) Become familiar with this instruction and the applicable requirements of Chapter 9920 of NAVSHIPS Technical Manual (NAVSHIPS 0901-920-0003).

(b) Assist the Gas Free Engineer and his authorized representatives in enforcing the requirements of this instruction and applicable requirements of Chapter 9920 of NAVSHIPS Technical Manual.

(c) Maintain a general awareness of the gas free status of affected spaces aboard ship and report immediately any discrepancies associated with toxicity and/or explosive atmosphere to the Gas Free Engineer or his authorized representative.

d. Industrial Relations Office will:

(1) Maintain currentness of this instruction by collaborating with the Gas Free Engineer on development of applicable changes.

(2) Periodically audit the Gas Free Engineering program and collaborate with the Gas Free Engineer advising or recommending improvements to the program based on the audit findings.

e. Industrial Hygienist will:

(1) When requested by the Planning Department, Production Department or the Quality Assurance Office, provide necessary tests (on a case basis) to determine the presence of toxic gas or vapor which may constitute a health hazard to personnel working in the suspected area.

(2) Provide consulting services, when requested on a case basis, relating to health hazards resulting from toxic gases.

(3) Become familiar with the requirements of this instruction and provide the Gas Free Engineer with additional technical support as appropriate.

f. All Other Departments accomplishing work aboard ship will:

(1) Familiarize themselves with gas hazards aboard ship and with the requirements of this instruction utilizing the services of the Gas Free Engineer or his authorized representative(s) when necessary.

(2) It is the responsibility of the head of each department, office, or division to assure that no work involving the possibility of

MT-PWHD 005624

REDACTED
J-M 83

gaseous hazards is undertaken prior to an inspection by, and the approval of, the Gas Free Engineer or his authorized representative. The supervisor at the job site requiring gas free certification will request gas free services prior to start of any work involving the possibility of gaseous hazards.

5. REQUESTING GAS FREE SERVICES

a. During the day shift on weekdays, all requests for gas free services will be referred to extension 6541 or 6542.

b. During the day shift on weekends and holidays, all requests for gas free services will be referred to extension 7930 or, if no answer, to the Service Group Security Watch, extension 7970 or 7993.

c. During the swing shift seven days a week, all requests for gas free services will be referred to extension 7930 or, if no answer, to extension 7970 or 7993.

d. During the graveyard shift seven days a week, all requests for gas free services will be referred to extension 7970 or 7993. Requests for gas free services on graveyard shift are considered of an emergent nature - therefore, such requests are to be so treated.

6. CERTIFICATION METHOD OF GAS FREE INSPECTION

The results of gas free inspection will be conveyed to cognizant codes in two ways; namely, by means of a "gas detection" report (Form 11ND-NSYLB-10330/3) and a tag, both of which shall show the ship, ship's compartment or space to which it applies and the date and time it was issued. If the results reflect a SAFE designation, the report and tag will show the date and time after which the SAFE condition cannot be depended upon to exist, and the SAFE notation is no longer valid.

Three copies of the gas detection report are prepared. One for the ship's O.D., one for the cognizant shop and one for the inspector's file. The lead shop copy and the ship's copy of the "gas detection" report will be delivered to the ship's officer-of-the-deck. The cognizant lead shop will obtain their copy of the "gas detection" report from the ship's O.D.

Additionally, a tag will be affixed to the entrance of the space to which it applies or in the case of piping it will be affixed to the piping in the most conspicuous location.

Prior to starting any work in a tank or closed space, the tag and the "gas detection" report shall be compared with each other in an

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J-M 83

effort to provide maximum assurance that the space/tank is safe for men and/or hot work.

In the event of any discrepancy between the findings on the tag and the associated "gas detection" report, such discrepancy will be immediately reported to the Gas Free Engineer or his authorized representative and no work will commence in the area in question until resolved affirmatively by the Gas Free Engineer or his authorized representative.

Multi-colored tags are used to denote various conditions found during the gas free inspection. The following is a breakdown of the meaning of each tag of a different color:

RED TAG - Not safe for men - Not safe for hot work. This classification is used on the tag for a space when the following conditions have been found to exist:

a. Workman is in danger of poisoning due to hydrocarbon or other gases present or likely to be evolved under prevailing conditions in excess of safe limits; or in danger of suffocation due to oxygen deficiency.

b. There is danger of fire or explosion in the presence of hot work due to the existence of concentrations of flammable vapors above safe limits; or due to the presence of residues likely to evolve dangerous amounts of flammable gases or vapors under the conditions prevailing; or due to the presence of flammable or explosive materials which are likely to be affected by the hot work; or due to the fact that surrounding spaces have not been protected as required.

YELLOW TAG - Safe for men with ventilation - Not safe for hot work. This classification is used on the tag for a space when the following conditions prevail:

a. Gases or vapors in excess of toxicity limits are not present and are not likely to be evolved under prevailing atmospheric conditions. The oxygen content of the air is sufficient for the workmen and the space is adequately ventilated.

b. There is danger of harm to workmen through fire or explosion in the presence of hot work when one or more of the conditions given above in paragraph b. under RED TAG prevail.

GREEN TAG - Safe for men with ventilation - Safe for hot work. This classification is used when:

2015

MT-PWHD-005626

a. Gases or vapors are not present or not in excess of toxicity limits; gases or vapors are not likely to be evolved under any working conditions likely to prevail; and the oxygen content of the air is sufficient for workmen; and the space is adequately ventilated.

b. Flammable or explosive materials or vapors are not present or have been removed, or adequately protected; and surrounding spaces have been protected as required.

BLUE TAG - Inerted - Not safe for men inside - Safe for men and hot work outside. This classification is used for a space when the following conditions prevail:

a. A non-flammable inert gas, such as carbon dioxide, nitrogen, or helium when available, has been introduced into the space in the amount or concentration required to reduce the oxygen content of the atmosphere to a level which will not support combustion or life.

b. Adequate measures have been taken to isolate the space from occupied spaces; and to ensure that it will remain isolated until the inerting medium is disposed of.

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J-M 83

MT-PWHD-005627

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J-M 83

used when the following conditions have been found to exist:

a. A nonflammable (inert) gas has been introduced into the space and its concentration is such that the oxygen content in the space will not support combustion or life.

b. Adequate measures have been taken to isolate the space from occupied spaces, and to insure that it will remain isolated until the inerting medium is disposed of.

6. Pressed-Up – Safe for Men and Hot Work Outside. To be used when the following conditions have been found to exist:

a. The space has been entirely filled with water or oil (the certificate shall show which liquid has been used – no other liquids are permitted to be used).

b. Means have been provided to verify that the level of the liquid remains at or above the topmost point of the space to be welded, and to insure that no person attempts to enter the space.

2074. EXPLOSIVES

1. Removal from Area. When the gas-free engineer finds that contemplated hot work is in the way of explosives, torpedoes, ammunition, etc., he shall comply with the Naval Ordnance Systems Command provisions to remove all explosives to safe storage until normal conditions are restored.

2. Responsibility for Moving. If the requirement that explosives be moved is applicable, the gas-free engineer shall notify the gunnery officer (or the first lieutenant on ships not having gunnery officer), who will be responsible for having the moving of the explosives done in the manner prescribed in Ordnance Manual OP5. The gas-free engineer shall not assume the responsibility of ordering that explosives be moved or of directing how they shall be moved; but he shall not issue a "SAFE" certificate for the space until he is satisfied that the explosives are a safe distance from the hot work. When he is satisfied, he shall classify and tag the space "safe for hot work."

2075. COMBUSTIBLE MATERIALS

When hot work is contemplated in the way of combustible materials, they shall be removed from the space, or steps shall be taken to protect the materials from the effects of the hot work. When the gas-free engineer is satisfied that adequate precautions have been taken, he shall classify and tag the space "safe for hot work."

2076. NAVAL VESSELS

1. For General Repairs and Overhaul. Vessels at commercial or naval shipyards or at advanced bases shall empty, clean, and gas-free all bulk storage tanks, cofferdams, pumprooms, and other spaces (such as shaft alleys, wells, sumps, bilges, and voids coated with bitumastic or filled with oil for corrosion protection) within which hot work is to be done and which is subject to accumulation of combustible or toxic gases. Bunker tanks containing fuel oil needed to keep steam up, or to keep auxiliary machinery operating, need not be emptied. Cargo-heating coils and cargo-smothering lines and vent lines shall be steamed and blown. Cargo pumps and cargo lines shall be blown with steam or flushed with water. Spaces thus cleaned and gas-freed shall be labeled "Safe for men – safe for hot work – EXCEPT on the piping." Bilges in Naval vessels undergoing overhaul shall be inspected frequently for the presence of oil. If detected, such bilge areas shall be cleaned and certified to be gas free. Welders and burners working in the vicinity of the bilges shall not permit an arc to be struck or a torch to be lighted until such bilge areas are certified safe.

2. Piping. Any piping, pumps, valves, etc. likely to contain flammable liquids (intake, discharge, distribution, and service systems; heating, displacement, smothering and vent systems; and ladders, grabs, etc., made of tubing in bulk tanks), on which hot work will be done, likely to be affected by hot work nearby, or not tight enough to prevent leakage into the space to be worked in or on, shall be disconnected and blanked off, and shall be cleaned and gas-freed or inerted.

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MT-PWHD-005628

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J-M 83

No "Hot Work" shall be undertaken until the gas free engineer has certified the systems safe with respect to danger from fire or explosion. The safety notation specified in the above paragraph shall be modified to indicate which piping is "Safe" and which is "Not Safe." Other spaces containing substantial quantities of liquids in "package stowage" or as a result of an accident in a free state, shall be emptied by any practicable means.

3. **Care of Adjacent Area.** The gas-free engineer should not confine his attention to the vessel alone. Utmost care should be taken to avoid spilling flammable liquids into a drydock or allowing oil or oily water to discharge overboard to create a serious fire hazard in harbor areas. When welding *inboard* alongside a pier, the pier in vicinity of the hot work should be "wet down" and any oil slick on the water around the vessel should be cleared. Waste, rags, etc. soaked with flammable liquids should be disposed of promptly and carefully.

4. **Restoring Operating Conditions.** When work is finished on a vessel, any tank vents, hatches, valves, etc. which were closed, locked, or sealed while hot work was in progress shall be checked to insure that proper operating conditions have been restored. This is especially important with regard to tank vents in order to avoid damage when tanks are refilled. Inert gases in spaces which must be entered shall be dissipated and the spaces certified and labeled in accordance with *NAVSHIPS Technical Manual*, article 9920.272 prior to entry.

2077. SUSPECTED COMPARTMENTS

1. **Gas-Free Engineer.** Every closed compartment or poorly ventilated space, and all tanks, shall be considered UNSAFE for hot work until the gas-free engineer has inspected the space and has indicated that adequate safety measures have been taken.

2. **Naked Lights.** Matches, cigarette lighters, open flames, ordinary electric lights, flashlights, or any sparking electric apparatus shall not be allowed in suspected compartments or in the vicinity of open hatches, etc., leading thereto. Portable lights used by cleaning parties shall be of the steamtight globe type, with any exposed metal parts of a nonsparking alloy or protected against striking a spark.

3. **No Smoking.** Smoking shall not be permitted in confined spaces or areas.

4. **Fire Extinguishers.** Suitable fire extinguisher apparatus shall be provided in the vicinity of unsafe compartments or spaces.

5. **Adjacent Spaces.** Each space that is subject to accumulation of hydrocarbon or other gases and is in contact with a space in or on which repairs will be made (including spaces in contact at the corners or in contact with the top or bottom) shall be inerted. Classify and label "INERTED – Not Safe for Men Inside – Safe for Men and Hot Work Outside." In the case of a minor repair, only those contacting spaces need be inerted which, in the judgment of the gas-free engineer, may possibly be affected by the hot work (as when working on the boundary of a tank but very close to the bulkhead between it and another tank). Other contacting spaces need not be inerted for a minor repair.

6. **Regeneration of Gas.** The possibility of regeneration of gas due to open pipes or other connections between clean and dirty tanks should be recognized and guarded against.

7. **Drifting Fumes.** Care shall be taken to insure that hatches, pipes, passageways, companionways, innerbottoms, etc. subject to gas accumulation, and not cleaned or inerted, are kept closed, and that vents are so arranged that flammable fumes or vapors cannot drift into the vicinity of the hot work. Tanks in which there is piping on which men are working, and spaces or piping that are inerted, should be isolated from other spaces containing toxic flammable liquids or vapors by blanking off interconnecting pipe lines, or by closing valves and securing rope or seizing wire or other suitable measures.

2019

MT-PWHD-005629

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J-M 83

8. **Leakage.** In addition to the cargo tanks, service tanks, ballast tanks, settling tanks, and other compartments in which the presence of flammable liquids is known it will be found that toxic flammable vapors from dripping of liquids from pipe joints, pumps, valves, and leaky containers, or from seepage, drainage, or other causes, often contaminate the air in pumprooms, cofferdams, cargo holds, shaft alleys, sumps, bilges, etc.

9. **Coated Containers.** Compartments which are often coated with bitumastic or filled with oil for corrosion protection, and which become filled with flammable vapors when heated, include voids, rudders, skegs, ramps (for landing craft), struts (fabricated), and water tanks.

10. **Water Tanks.** Always use care in entering or working on water tanks. Even if they are *not* coated with bitumastic, or are not near enough to oil tanks to be subject to oil leakage, they frequently contain explosive, toxic methane (marsh gas) from the decomposition of organic materials in stagnant water.

11. **Changing Conditions.** Shifting of ballast, disconnecting of pipe lines, shifting of the vessel from one berth to another and similar operations may result in release of flammable liquids or vapors. If such operations are done after a "SAFE" certificate has been issued, particular care should be exercised to insure that an unsafe condition has not been created.

12. **Examination, Cleaning and Painting.** When a vessel is in a shipyard for this purpose, the gas-free engineer shall exercise extra vigilance to make sure that incidental repairs involving hot work for which the need has become evident in the course of other work, are not undertaken until the location has been inspected and any necessary safety measures taken. While the vessel is in the shipyard, all spaces subject to gas accumulation shall be kept closed; or shall be opened and entered only after the proper precautions as prescribed by the gas-free engineer have been taken.

2078. AIR SAMPLING AND ANALYSIS

1. **Testing Air.** The air in tanks which have been empty for a long time and the air in other closed or poorly ventilated spaces shall be tested for the presence of toxic or flammable concentrations of hydrocarbon or other vapors and for sufficiency of oxygen. Air conditions shall be checked with the oxygen indicator and the combustible gas or carbon monoxide gas indicator, or by chemical analysis as frequently as circumstances appear to require. A check shall be made before men enter if work has been suspended overnight or for any similar period. Persons entering spaces for gas tests should be equipped with air-line masks and lifelines tended by reliable men outside. If one or more of the tests show any positive indication of the presence of any flammable vapor, regardless of whether it is below, within, or above the explosive range, the space shall be gas-freed and cleaned by the applicable procedures.

2. **Measuring Oxygen Concentration.** The flame safety lamp has been used for many years to determine the presence or absence of sufficient oxygen to support life. Today, however, dependable portable oxygen indicators are abundantly available and shall be used in lieu of the flame safety lamp. These instruments are easier to handle and maintain, and since they do not use an open flame they are safer.

3. **Combustible Gas Indicators.** These indicators are capable of detecting all mixtures of air or oxygen with combustible gases or vapors from fuel oils, gasoline, alcohol, acetone, and of illuminating or fuel gas, hydrogen, and acetylene. They are sensitive in showing the presence of concentrations of these vapors or gases up to the lower explosive limit and give an accurate measurement of the percentage concentrations of the mixture if it is in or beyond the explosive range. They are *not*, however, sufficiently sensitive to measure accurately the small concentra-

MT-PWHD-005630

REDACTED
J-M 83

tions of flammable gases which can have an appreciably toxic effect when breathed for an extended period of time (8 hours or more), nor do they detect nonflammable gases which are toxic.

4. Carbon Monoxide Indicators. These devices are much more sensitive in detecting carbon monoxide than the combustible-gas indicators but are limited to the detection of this one gas.

5. Determination of Safe Conditions. There is satisfactory assurance of freedom from toxic concentration of flammable gases when:

a. the space has been thoroughly ventilated;

b. tests with the combustible-gas indicators (and with the carbon monoxide indicators when available) have given *no* indication of the presence of combustible gases (if any gas is indicated by the instrument, even though below the flammability limit, it is probable that the concentration is above the toxicity limit); and

c. tests with the flame safety lamp have indicated no oxygen deficiency.

6. Physical Symptoms Indicating Toxic Gas. The conditions noted above do not give positive assurance of freedom from toxic concentrations of nonflammable gases such as carbon-dioxide, nitrogen, carbon-tetrachloride, and of vapors. However, when the space has been thoroughly ventilated, and there is no oxygen deficiency as indicated by the oxygen indicator, workers in such atmospheres will receive warning of danger through such symptoms as labored breathing, excessive fatigue from slight exertion, dullness, etc., a considerable time before more serious reactions are experienced.

2079. TOXIC GASES

1. Physical Effects of Petroleum Vapor. Breathing of the vapors from petroleum products gives effects ranging from mild exhileration, irritation of the eyes, severe headache, complete intoxication, unconsciousness and death. The effects become more pronounced as the percentage of concentration and time of exposure are increased. An added danger associated with breathing these vapors is the danger of accidents resulting from the dizziness induced by small concentrations not otherwise harmful.

2. Use Masks if in Doubt. The usual portable combustible gas indicators are not sensitive enough to determine whether or not a small concentration of combustible gas is above or below the toxicity limit. If accurate determination of the gas concentration is desired, chemical laboratory analyses of air samples are necessary. However, the safest procedure is to eliminate dangerous gases and vapors entirely, or to use air-line masks when working for extended periods in suspected atmospheres.

3. Carbon Monoxide. Carbon monoxide may be present in compartments painted with a linseed oil base paint and sealed immediately thereafter.

4. Hydrogen Sulfide. Hydrogen sulfide and other toxic gases will be generated by mildewing or rotting foodstuffs or other organic matter, such as cloth, leather, and wood. Mildewing and rotting are accelerated when the space is warm and humid.

5. Carbon Dioxide. An excess of carbon dioxide is frequently found in refrigerator spaces even though the spaces are undamaged and the foodstuffs are perfectly edible. This is due to the lack of ventilation and the tendency of foods to absorb oxygen slowly and give off CO_2. The concentration is rarely high enough to be dangerous unless a man stays in the space longer than a few minutes at a time, in which case he is liable to be overcome and eventually suffocated.

6. Oxygen Deficiency. Oxygen deficiency can be caused by the rusting of metal which has been cleaned to bare metal and then sealed. The mildewing and rotting of organic material in closed compartments can also cause an oxygen deficiency.

MT-PWHD-005631

0008 1313

REDACTED

J-M 83

2080. INERTING AND PRESSING UP

1. **Inerting with Gas.** In an apparently clean container there may still be traces of oil or grease under the seams even though the vessel may have been cleaned and flushed with caustic soda solution. The heat of the welding or cutting operation may cause such oil or grease to give off flammable vapors to the extent that an explosive mixture may be formed inside the container. Such mixtures can be prevented from burning or exploding by mixing in a quantity of an inert or nonflammable gas to displace a substantial percentage of the volume of the vapor-air mixture. Carbon-dioxide, nitrogen, and helium are suitable for this purpose.

2. **Blanketing with Steam.** When making emergency repairs and when it is impractical to obtain or use one of the inert gases or to clean and gas-free the spaces, steam may be used in lieu of inert gas to blanket the compartment. However, steam shall *never* be used under any circumstances in spaces containing flammable materials in closed containers, or in magazines or spaces adjoining magazines.

3. **Pressing-Up.** Pressing-up is an alternative to inerting. In this procedure, the tank or space shall be completely filled with water, fuel oil, or lubricating oil. The gas-free engineer shall take steps to ensure that there are no pockets between structural members, on the high side under a slanting top, or on a listed ship into which the vapor-air mixture will be compressed and from which the liquid will be excluded.

4. **Venting of Containers.** Make sure that jacketed container or other hollow parts are sufficiently vented before heating, welding, or cutting. Remember that air or any other gas which is confined inside a hollow part will expand greatly when heated. The internal pressure created may be sufficient to cause the part to act like a bomb.

5. **Be Suspicious of Light Metal Parts.** A metal part which is suspiciously light is probably hollow, and should be drilled to vent it before heating. Every possible precaution should be taken with jacketed vessels, tanks, or containers to sufficiently vent the confined air before doing any hot work.

6. **Vents.** Vents and telltales shall be provided when needed, to eliminate vapor pockets and to verify the liquid level. However, drilling and tapping for them shall *not* be permitted on gasoline or alcohol tanks, but may be done on other tanks. Drilling and tapping shall be done *slowly* under a steady stream of water.

7. **Oil Filled Spaces.** Spaces entirely filled with oil should be vented before heating to prevent damage due to expansion of the oil.

LABELING

2085. PURPOSE.

The development of new chemical products and the introduction of new chemical processes make it mandatory that precautionary measures be taken during the handling of toxic and dangerous chemicals. Warning labels affixed to containers of hazardous materials are one of the most practical means of accomplishing this objective. The purpose of these instructions are to provide information as to the labeling and marking system provided for Navy-wide use through NAVMAT-INST 5100.3.

2086. SCOPE.

The hazardous materials to be labeled are listed in MIL-STD 1341 (SA). The labeling is intended for rapid recognition of containers during handling and storage operation both afloat and ashore.

1. **Exclusions.** The following materials are excluded from the Navy labeling system

MT-PWHD-005632

0008 1314

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since specific programs and current instructions are provided for each of these materials; ammunition; weapons; explosives, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies and bulk fuels.

2. **Labeling and Marking System.** Labeling and marking of hazardous material shall be in accordance with MIL-STD 1341 (SA). MIL-STD 1341 (SA) is essentially the marking and labeling system of the National Fire Protection Association (NFPA) 704M. MIL-STD 1341 (SA) requires that the specified labels and marking be applied to hazardous material by the Supplier to the Navy to each unit, intermediate, and shipping container, unit loads and individual components within kits and sets. Hazardous Materials obtained through the Navy supply system will be so marked and labeled. Activities and ships procuring from sources other than the Navy supply system shall assure that labels and marking in accordance with MIL-STD 1341 (SA) are applied.

2087. RESPONSIBILITIES.

1. **Chemical Control Committee.** At each activity and ship there should be established a Chemical Control Committee, or equivalent thereof to administer the technical aspects of the labeling program and to keep the program current. Directives should be prepared by the committee for promulgation by the commanding officer. These should be based on applicable instructions and should be tailored to suit the needs of the ship or activity. The size and nature of the ship or activity will be a major factor in determining whether this committee will be a formal organization composed of cognizant personnel, or whether it will consist of one individual to whom this additional responsibility is delegated.

2. **Supply Officer.** The Supply Officer of each activity and ship shall be responsible for assuring that local purchases of hazardous material are made in accordance with MIL-STD 1341(SA) or that the labeling and marking in accordance with MIL-STD 1341 (SA) are applied upon receipt of hazardous material.

3. **Supervisors.** Supervisory personnel shall be responsible for the proper labeling of any containers to which hazardous materials may be transferred after receipt in their work areas.

4. **Management.** Cognizant management personnel shall institute a training program to familiarize personnel with the Navy labeling system emphasizing the significance of the color coding and the hazard classification and the numbers designating the degree of hazard.

2088. ADDITIONAL LABELING.

It may be necessary on occasion for qualified investigators, (Physicians, Chemists, Hygienists, Safety Personnel, Toxicologists, Fire Prevention Personnel), to work with new products before adequate chemical, physical, and toxicological data are available. To cover such cases *only*, the following label shall be used during the period of investigation–

(Name or description of product)
FOR INVESTIGATIONAL USE ONLY
Statement of Known Hazards
(Appropriate precautionary measures) (Appropriate instructions in case of contact or exposure)
IMPORTANT! The chemical, physical and toxicological properties of this product have not been fully investigated and its handling or use may be hazardous.
EXERCISE DUE CARE

NAVMATINST 5100.3 provides for the action to be taken (Request to BuMed) when the hazards of the material cannot be determined locally.

2023

MT-PWHD-005633

REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 2087.1

Subj: Chemical Control Committee

Ref: (a) NAVMAT P-5100, Chapter 20, Article 2087

1. PURPOSE. This supplement is issued to expand reference (a) with the functions and responsibilities of the chemical control committee.

2. CHEMICAL CONTROL COMMITTEE

a. Membership

Material Division Superintendent (Code 560), Supply Department, Chairman

Head, Laboratory Division (Code 134), Quality Assurance Office

Head, Safety Division (Code 185), Industrial Relations Office

Head, Industrial Hygiene Division, NRMC Dispensary, LBNS

Fire Chief (Code 835), Administrative Department

Representative, Administrative Division (Code 302.2), Production Department

b. Meetings

The committee will meet quarterly at the time and place designated by the chairman.

c. Functions and Responsibilities

(1) To establish procedures for the labeling of hazardous industrial chemicals and materials used in the Shipyard.

(2) Study the effectiveness of the program and recommend revisions as necessary to keep the program current and effective.

(3) Prepare and forward directives for approval when additional controls appear necessary.

(4) Arrange for appropriate labeling of materials at supply sources where possible.

(5) Render technical advice as necessary.

2024

MT-PWHD-005634

0008 1316
REDACTED
J-M 83

2089. AVAILABLE LABELS.

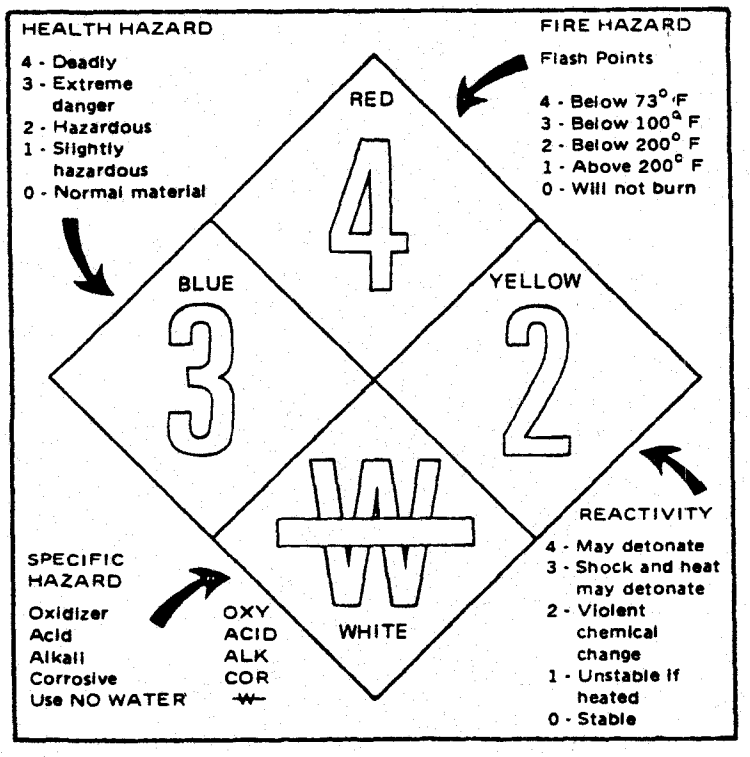
Pressure sensitive paper labels in accordance with the MIL-STD 1341 (SA) are available in Navy supply. Their form numbers and ordering information are given in NAVSUP Publication 2002, *Navy Stock List of Forms and Publications*.

2090. LABEL DESIGN.

The label identifies the hazards of a material in terms of three principal categories, namely, "health," "flammability," and "reactivity (instability)"; and indicates the order of severity numerically by five divisions ranging from "four (4)," indicating a severe hazard, to "zero (0)," indicating no special hazard. This information is presented by a diamond shaped diagram divided into four diamond shaped diagrams. The "health" hazards will always be shown by the diamond on the left, (blue background or blue numerals). The "flammability" hazards will always be shown by the diamond at the top. (Red background or red numerals). "Reactivity" hazards will always be shown by the diamond on the right (yellow background or yellow numerals). The bottom diamond (white) will indicate specific types of hazard including the symbol W which means "Do not use water if this material is burning (or near something that is burning)." Other symbols used alone or in combination with each other or W are:

OXY Oxidizer	Do not store with combustible material
ACID Acid	
ALK Alkali	
COR Corrosive	

1. Sample Label.



MT-PWHD-005635

REDACTED

J-M 83

2. Explanation of Label Designations.

HAZARD IDENTIFICATION SYSTEM

Identification of Health Hazard Color Code: BLUE		Identification of Flammability Color Code: RED		Identification of Reactivity (Stability) Color Code: YELLOW	
	Type of Possible Injury	Susceptibility of Materials to Burning		Susceptibility to Release of Energy	
Signal		Signal		Signal	
4	Materials which on very short exposure could cause death or major residual injury even though prompt medical treatment were given.	4	Materials which will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or which are readily dispersed in air and which will burn readily.	4	Materials which are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials which on short exposure could cause serious temporary or residual injury even though prompt medical treatment were given.	3	Liquids and solids that can be ignited under almost all ambient temperature conditions.	3	Materials which are capable of detonation or explosive reaction but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.
2	Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.	2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2	Materials which are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form potentially explosive mixtures with water.
1	Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given.	1	Materials that must be preheated before ignition can occur.	1	Materials which are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0	Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	0	Materials that will not burn.	0	Materials which are normally stable, even under fire exposure conditions, and which are not reactive with water.

2026

MT-PWHD-005636

0008 1318

REDACTED
J-M 83

LBNS SAFETY SUPPLEMENT NO. 2090

Subj: Hazardous Material Control

Ref: (a) NAVMAT P-5100, Chapter 20, Article 2090
(b) Fed. Std. No. 313, Symbols for Packages and Containers for Hazardous Chemicals and Materials.
(c) NAVSUPPUB 4500, Consolidated Hazardous Items List (CHIL)
(d) NAVSHIPSINST 5100.29

1. PURPOSE. To supplement reference (a) with additional instructions on the labeling and control of hazardous industrial chemicals and materials.

2. DEFINITION. As used in this supplement, hazardous material is defined as any material which, by virtue of its potentially dangerous nature, requires controls to assure adequate safety to life and property. The definition excludes ammunition, weapons, explosives, explosive-actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, bulk fuels, and nuclear materials, which are covered by other directives.

3. SCOPE. This supplement governs the control and labeling of hazardous chemicals and materials, both standard and non-standard items, received from any source of supply, if such material is intended for ultimate storage, handling, use, or disposal at this shipyard.

4. POLICY.

a. Control. The quantity of hazardous material procured and utilized by this activity will be kept at a minimum consistent with operational requirments. Every effort must be made to utilize non-hazardous materials in lieu of hazardous materials or use the smallest quantity of hazardous material that can accomplish the task.

b. Labeling. Packages and containers of hazardous chemicals and materials will contain hazard identifying information in accordance with reference (b). When materials are broken down into smaller units, this information will be transferred to the new container. Particular emphasis will be placed on assuring appropriate hazard identification for the end user.

2027

MT-PWHD-005637

REDACTED
J-M 83

5. LABEL DESIGNATION.

a. Standard Stock Items. Items within the Federal Supply System which are presently classified as hazardous and must be properly labeled are listed in reference (c), The Consolidated Hazardous Items List (CHIL). This reference lists hazardous materials in both Federal Item Identification Number and nomenclature sequence. The list will be used to determine the labels applicable to each standard stock item and will be made available at every location where hazardous material may be initially recieved or stored, or where hazardous material containers are refilled.

b. Non-Standard Items. The designation of an appropriate label for each non-standard hazardous material will be made on an individual basis as described below.

c. The Industrial Hygienist (Code 730) will be consulted when there is any doubt concerning the assignment of a proper label for a particular hazardous item.

6. LABEL APPLICATION. The following procedures will be used in labeling hazardous industrial chemicals and materials:

a. Appropriate labels will be placed in a conspicious position on all containers. This requirement applies to the original container, and to any other container into which the material is subsequently transferred.

b. Labels will not be superimposed upon nor replace existing labels.

c. Decals, markings or other signs placed on hazardous materials either by the manufacturer or authorized government activity will not be removed, altered or defaced by employees, except those personnel authorized and specifically directed to do so by proper authority.

7. RESPONSIBILITIES.

a. Heads of Departments and Offices will:

(1) Ensure that the use of hazardous chemicals and materials by employees under their cognizance is kept to a minimum consistent with operational requirements to accomplish the task and, when hazardous materials are used, all safety precautions, procedures and protective equipment is used.

2028

MT-PWHD-005638

REDACTED
FM 83

(2) Ensure that personnel under their cognizance use only properly labeled containers for hazardous chemicals and materials. This includes any and all containers into which chemicals and materials may be transferred by employees subsequent to original issue.

(3) Provide for the instruction of employees handling such materials in the procedures and requirements of this supplement and in safe-working techniques.

(4) Ensure that adequate supplies of warning labels are maintained at appropriate locations near such materials, viz., in storeroom, toolroom, or offices.

(5) In the case of the proposed introduction of chemical substances of undetermined toxicity or new processes using new chemicals or old chemicals in radically different ways, notify the Industrial Hygienist (Code 730) for an evaluation. The Industrial Hygienist will be provided full details in writing as soon as possible to avoid delays.

b. The Supply Department will:

(1) Assure that all hazardous materials issued for use, whether from the Supply Department or delivered directly from a vendor to the user, are properly labeled in accordance with the provisions of this Supplement.

(2) Take the following actions before releasing for Shipyard usage non-standard materials believed to be hazardous.

(a) Provide the Industrial Hygienist (Code 730) with product information/copy of requisition and other assistance as requested. The Industrial Hygienist will then prepare a Material Safety Data Sheet (Form DD 1813) and determine proper label assignment.

(b) Based on information provided by the Industrial Hygienist, apply appropriate labels to packages or containers of material.

(c) Submit Material Safety Data Sheet (Form DD 1813) to the Commander, Naval Ship Engineering Center (SEC 6105) and to the Commander, Navy Fleet Material Supply Office (FMSO) in accordance with reference (d).

(3) Prepare and maintain records of all non-standard item label assignments.

c. The Industrial Hygienist (Code 730) will:

(1) Serve as a consultant to Departments and Offices in evaluation of potential damage to health of employees and, if necessary,

MT-PWHD-005639

REDACTED
J-M 83

advise on proper control procedures for protection of health of employees exposed to hazardous materials.

(2) Assemble all available toxicological data on chemicals of unknown toxicity and based on existing information, evaluate the potential hazards under the conditions of intended use. The materials in question usually are nonstandard items that are sold under trade names and often are combinations of hazardous chemicals. The Shop will be advised of the outcome of the evaluation. Control procedures will be provided when found necessary. Change in course of action may be indicated in particular instances and the Shop will be so notified.

(3) Prepare a Material Safety Data Sheet (Form DD 1813) and determine proper label assignment for non-standard hazardous materials. This information will be submitted to the Supply Department and other cognizant codes for appropriate action.

(4) Request any assistance required from other Departments and Offices for making evaluations/label assignments.

d. The Quality Assurance Office (Code 130) will assist the Industrial Hygienist when requested in determining the hazardous nature of non-standard items.

e. The Safety Division will:

(1) Audit procedures for handling hazardous materials to assure compliance with this Supplement.

(2) When requested, assist departments and offices in the training and indoctrination of personnel handling hazardous material in the requirements of this supplement and procedures to be followed to avoid injury or property loss.

f. The Chemical Control Committee will maintain surveillance over the labeling program and initiate revisions when required.

MT-PWHD-005640

0008 1322

REDACTED
J-M 83

3. Interpretation of Sample Label. As an example of rapid recognition of the hazards of a material labeled the same as the sample label, an observer can immediately determine the hazards of the material as follows:

a. An extreme health hazard exists (left diamond, blue color, numeral "3") and that personal protection is required (respirators, eye protection, etc.).

b. The worst possible fire hazard exists (top diamond, red color, numeral "4"), special firefighting and fire protection required.

c. The material will react violently under fire conditions (right diamond, yellow color, numeral "2"), evacuation plans necessary.

d. The use of water is prohibited, ("W" with slash line through it) and that a dry chemical or CO_2 extinguishing agent must be used.

2091. GUIDANCE ON HAZARDOUS MATERIALS

Of the references on hazardous materials listed at the end of this chapter, two are particularly mentioned because of their significance. NAVSUP publication 4500, *The Consolidated Hazardous Item List (CHIL)*, Cog I Stock No. 0588-005-0000 provides all Navy users with a consolidated listing of potentially hazardous items in the supply system. All ships and stations should procure the publication for guidance. NFPA (National Fire Protection Association) publication, "Fire Protection Guide on Hazardous Materials," (to be listed under Cog I procurement) furnishes information on the hazards of materials in order to prepare for emergencies involving them. Ships and stations should procure the publication when it is made available.

MT-PWHD-005641

REDACTED
J-M 83

INDEX

MT-PWHD-005642

0008 1324

REDACTED
J-M 83

INDEX

A

Abrasive blasting, 1320-1330
  automatic safety shut-off, 1322.2
  bodily contact, 1323
  communication, 1327
  dust, 1325
  equipment, 1322
  high pressure air flasks, 1330
  line, surges in, 1326
  machine operation, 1329
  staging, 1328
Abrasive grinding wheels, metal, 0926
  portable, power, 1433
Accident causes, materials handling, 0301
Acetone, 2055.5
Acetylene, compressed, 1021
Acetylene cylinders, 1021
Acids and alkalies, 2005
Acid transfer, 2006
Adzes, 1403
Air compressor pipelines, 1215
Air compressors, 0737
Air compressors and tanks, 0523.6
Air lines, main machinery, 0703
Air receivers, 0735-0736
Aircraft, crash and rescue, 0405
  defueling, 0419
  engine operations, 0417
  fuel cell repair, 0410
  fuels and fueling operations, 0418
  movement, 0407
  servicing and ground testing, 0408
  taxiing, 0407.2
  tire maintenance, 0409
Aisles, building, 0202.4
  working, 0312
Ambulance safety, 1603
Ambulances, 0515.2
Amyl acetate, 2055.6
Antennas, working on, 1545
Arc welding, 1035-1039
  electrode holders, 1036
  equipment, 1006.5a
  inert-gas, 1039
  protection from shock, 1035
Aromatic naptha, 2055.2c
Arresting gear, aircraft, 0423
Asbestosis, 2058.2
Asphalt plants, 0831.3
Automotive equipment, airfield, 0414
Automotive fire apparatus, 0515.3
Axes, 1403

B

Band saws, wood, 1111
  guards, 1111.2b
Barber shop, exchange, 1918
Barriers and barricades, aircraft, 0423
Bars, wrecking, 1416
Batteries, charging, motor vehicle, 0524.6
  charging, 1520.1b
  dry cell, 1520.2
  mercury, 1520.2c
  wet cell, 1520.1
Battery shops, aircraft, 0415
Beaders, sheet metal, 0923.3
Beauty shop, exchange, 1919
Belts, seat, motor vehicle, 0513.4
Benzene, 2055.2a
Beryllium, 2057.1
Bits, boring, 1404
Bituminous coatings, 1313
Blasting, 0855-0864
  abrasive, 1320-1330
  air compressors, portable, 0858
  drilling, 0857
  electrical wiring, 0862
  explosive, stowage and handling, 0856
  inspection after, 0863
  loading charges, 0859
  machines, 0861
  misfires, 0864
  preparation for firing, 0860
Blowtorches, gasoline, 1216
Boats, 0630-0637
  fire prevention, 0635
  fueling, gasoline, 0636
  operation, 0632
  operator qualifications, 0632.1
  posting safety precautions, 0634
  safety equipment, 0633
  starting engine, 0637
Boatswain's chair, 0836.11
Boiler furnace, entering, 0725.3d
Boiler water, testing, 0725.2c
Boilers, stationary, 0725-0727
  attendance, 0726.1b
  cleaning and repairing, 0725.3
  firing, 0726.2
  operating precautions, 0726
  testing and inspection, 0725.2
  unattended, 0726.10
  valve pull chains, 0726.11
  valves, 0726.4
  water level, 0726.3

MT-PWHD-005643

0008 1325
REDACTED
J-M 83

Bolo, knife, 1418
Bombs, photoflash, 1805.5
Bonding, fueling nozzles, 2017.5d
  gasoline hose, 2021.8
Boring machines, wood, 1117
Boring mills, metal, 0919
Braces, boring, 1404
Brakes, hand, sheet metal, 0923.4
Buffers, metal, 0926
  portable, power, 1433
Building, fire prevention, 0205
  floors, 0202.5
  rubbish disposal, 0202.3
  stairs, 0202.6
  walkways and aisles, 0202.4
  warning signs and barricades, 0202.2
Bulbs, photoflash, 1805.3
Bulldozers, 0874
Burning, construction site, 0872
Buses, general precautions, 0515.1a
  school, 0515.1b
Butcher shop, commissary, 1906
  electrical equipment, 1906.4
Butyl acetate, 2055.6
Butyl alcohol, 2055.4c

C

Cable, electrical, 1517
Cables, arc welding, 1037
Cadmium, 2057.2
Capacitors, preventing shock from, 1542.2
Car pits, motor vehicle, 0524.5
Carbon monoxide indicator, 2078.4
Carbon tetrachloride, 2055.3b(1)
Cargo handling, 0601-0613
  flammables, 0610-0613
  fuel and diesel oil, 0610.2
  gear, ships, 0603.2
  personnel safety, 0602
Cargo, breaking down, 0605.1
  discharging, 0604
  dunnage, 0605.3
  loading, 0604
  moving, 0604.2
  tiering and blocking, 0605.2
Case hardening, cyanide, 0955
Catapults, aircraft, 0424
Cathode-ray tubes, 1546
Chains, 0823
Chairs, office, 0204.4
Chemical hazards, photographic, 1806
Chemical storage, laboratories, 1707
Chemicals, handling, laboratories, 1708
  photographic, mixing, 1806.4
Chemicals, principal, 2007
  acetic acid, 2007.1
  ammonia, 2007.11
  carbolic acid (phenol), 2007.2
  caustic potash (potassium hydroxide), 2007.12
  caustic soda (sodium hydroxide, lye), 2007.13
Chemicals, *continued*
  chromic acid (chromium trioxide), 2007.3
  hydrochloric acid, 2007.4
  hydrofluoric acid, 2007.5
  mixed acid, 2007.7
  nitric acid, 2007.6
  oxalic acid, 2007.8
  soda ash (sodium carbonate), 2007.14
  sodium bisulfate (sodium acid sulfate), 2007.10
  sulfuric acid, 2007.9
Chicken ladders, 0836.20
Chisels, wood, 1405
Chlorinated solvents, inert-gas welding, 1039.1
Chlorine leaks, water treatment plants, 1233
Chlorine poisoning, first-aid, 1234
Chlorobenzene, 2055.3b(4)
Chopper, food, 1907.2g
  vegetable, 1907.2d
Chromium, 2057.3
Circuit breakers, 1514
Circular resaws, 1110.8
  guards, 1110.8
Circular saws, portable, 1110.10
  guards, 1110.10
Circular saws, wood, 1110
Cleaners, paint, 1316
Cleaning and finishing rooms, foundry, 0946
Clearing and grading, 0870-0876
Closed compartments, certification, 2071
  safety notations, 2073
Cloth cutters, tailor shop, 1916.2d
Clothing hazards, commissary, 1901.3
Coal, extinguishing fires, 2036.4
  handling, 2035
  spontaneous ignition, 2036
  storage, 2036.2; 2036.5
Cobbler shop, exchange, 1915
Coffee grinder, commissary, 1905.1
Coffee urn, 1908.1b
Combustible gas indicator, 2078.3
Combustible materials, near hot work, 2075
Commissary facilities, 1901-1906
Compressed air tanks, 0735-0736
Compressed gases, 2040-2049
  acetylene, 1021
  ammonia, 2049.4
  carbon dioxide, 2049.2
  chlorine, 2049.3
  combustible, 2049.6
  freon, 2049.5
  oxygen, 1022
Compressors, air, 0737
Concrete bucket towers, 0830.7
Concrete construction, 0814
Concrete equipment, 0831
Concrete mixers, 0831.2
Confined spaces, air sampling, 2078
  inerting, 2080.1
  on naval vessels, 2076
  pressing up, 2080.3

2034

MT-PWHD-005644

0008 1326

REDACTED
J-M 83

Confined spaces, *continued*
suspected compartments, 2077
toxic gases, 2079
working in, 2070-2080
Construction equipment, 0820-0831
accident causes, 0820.2
color code, 0820.3o
operator qualifications, 0820.3a
signals, 0820.4
Cooker, pressure, 1907.2k
Core making, foundry, 0939
Crane operation, 0825
Crane operators, 0825.3-4; 0820.3a
Crane safety devices, 0825.16
Cranes, crawler, 0826
floating, 0828
gantry, 0828
hammerhead, 0828
locomotive, 0827
overhead, traveling, 0828
portal, 0828
tractor-mounted, 0826
truck, 0826
Crawling boards, 0836.20
Crowbars, 1416
Crucibles, foundry, 0941-0945
Cube steak machine, 1906.4c
Cupolas, foundry, 0940
Cutters, cloth, tailor shop, 1916.2d
diagonal, 1410
food, 1907.2f
pipe, 1409
side, 1410
Cyanide, sodium and potassium, 0955
Cylinder valves, gas welding, 1023
Cylinders, compressed gases, 2040-2049
care, 2044
empty, 2048
handling, 2045.2
painting, 2042
repairing, 2043
storage, 2045.1a; 2046
testing, 2044
toxic hazards, 2047
Cylinders, gas welding, 1020-1021
oxygen, 1022
shipboard, 1028.2b

D

Dairy department, commissary, 1905.2
Defueling aircraft, 0419
Demolition, 0840-0849
catch platforms, 0847
preparation of location, 0842
removal of floors, 0848
removal of materials, 0844
removal of walls, 0846
sidewalk sheds, 0843
stairs, passageways, and ladders, 0845
steel construction, 0849
Dempster-dumpster, 0515.5
Derricks, 0829
breast, 0829.2
guy, 0829.6
stiff-leg, 0829.5
Desks, office, 0204.3
Diagonal cutters, 1410
Dies, threading, hand, 1414
Dipping material, 0954
Dipping, paint, 1315
Dishwashing machine, 1909.2b
Ditching machines, 0888
Diving, 0625-0626
general, 0625
self-contained, 0626
Doors, building, 0202.7
Dope room, aircraft, 0416
Draw knives, 1116
Dredging, 0892
Drift pins, 1405.8
Drill presses, metal, 0918
Drills, hand, 1406
portable power, 1426
rock, pneumatic, 1428
Drinking water, construction site, 0802
Dry cleaning equipment, 1917.4
Dry cleaning operations, 1917.5
Dry cleaning shop, exchange, 1917
Dumbwaiters, 1910
Dusts, mineral, 2058
plastic, 2056.1

E

Electric power lines, equipment, 1531
handling wire, 1532
potheads, 1534
preparing trees, 1533.6
underground, 1535
working on, 1530-1535
Electric wiring, blasting, 0862
construction site, 0809
Electrical apparatus, laboratory, 1705
Electrical circuits, checking, 1525.3
energized, 1525
high voltage, 1525.4c
intermediate voltage, 1525.4b
low voltage, 1525.4a
Electrical equipment, 1510-1520
aircraft, 0422
construction site, 0809
inspection and maintenance, 1503
photography, 1804
portable, 1513
Electrical installations, building, 0220
main machinery, 0705
Electrical machinery, starting, 0705.2
Electrical shock, special precautions, 1501.11
resuscitation, 1501.12
Electrical substation fencing, 1516

MT-PWHD-005645

0008 1327

Electrode holders, arc welding, 1036
Electron tubes containing radioactive materials, 1548
Electronic equipment, servicing, 1542.5
repair, 1542.6
Electronic flash equipment, 1805.4
Electronic safety, 1540-1549
Electronics, aircraft, 0422
Electroplating shops, 0964
Elevator safety, 0221
Elevators, construction, 0830
Emergency conditions, 0103.3d
Engine, power boat, starting, 0637
Engine operations, aircraft, 0417
Epoxy resins, 2056.2
Ethyl acetate, 2055.6
Ethyl alcohol, 2055.4b
Excavation, 0880-0892
bracing of, 0882
public protection, 0881
Exchange, facilities, 1915-1921
Navy, 1902
Explosives, blasting, stowage and handling of, 0856
near hot work, 2074
transporting of, 0517
Extractor, dry cleaning, 1917.4d
laundry, 1921.5b
Eye protection, welding, 1011

F

Fans, office, 0204.7
Fencing, electrical substation, 1516
Files, tool, 1407
Filing cabinets, office, 0204.2
Film, photographic, 1803
Fire extinguishing, petroleum fuels, 2019
Fire fighting equipment, petroleum fuels, 2018
Fire Hazards, painting, 1301
Fire prevention, aircraft operations, 0402
boilers, stationary, 0727
construction site, 0813
dry cleaning, 1917.6
electricity, 1502.1
garage, 0522
general, 0205
laboratories, 1706
main electrical machinery, 0705.4
power boats, 0635
railroads, 0503
warehouse, 0313
woodworking, 1107.3
First-aid stations, 0804
Flame arresters, power boats, 0635.1b
Flammables, cargo handling, 0610
loading in port, 0611; 0612
night loading, 0612.4
precautions after loading or discharging, 0613
safety during loading, 0612.2
Flash bulbs, photographic, 1805.3
Flash equipment, electronic, 1805.4
photographic, 1805
Flash point, petroleum fuels, 2012
Floating equipment, (*see* Boats) 0630-0637
Floor capacities, warehouse, 0310
Floor covering, insulating, electrical, 1501.3
Floors, building, 0202.5
Foamed plastics, 2056.3
Food chopper, 1907.2g
Food cutter, 1907.2f
Forges, 0950-0957
Fork trucks, 0321
Forming rolls, metal, 0925
Foundries, 0935-0946
health requirements, 0935
Fountain, mess, 1908.1c
Freezer, ice cream, 1908.1d
Freon, compressed, 2049.5
Fryer, deep fat, 1907.21
Fuel dispensing nozzles, automatic, motor vehicle, 0525.3c
Fuel, JP-5, 2022
Fuel oil, vapor, 2015
Fueling, motor vehicles, 0514.3; 0525
Fueling operations, aircraft, 0418
Fueling, gasoline power boats, 0636
Fuels, petroleum, 2010-2022
accidental ignition causes, 2017
controlling vapors, 2016
storage, 2013
Furnace, stationary boiler, entering, 0725.3d
Furnaces, forge, 0953
foundry, 0940
liquefied petroleum gas, 1217
plumbers, 1216
Fuses, electrical, 1518

G

Galley, messing, 1907
equipment, 1907.2
Galvanized steel, welding, 1052
Garage safety, 0520-0525
Garages, fire prevention, 0522
tools and equipment, 0523
Gases, compressed, 2040-2049
medical, handling of, 1601
Gas-free engineer, 2072; 2077.1
Gas welding cylinders, 1020-1022
Gas welding equipment, 1006.5b
Gasoline, 2021
bulk handling, 2021.7
explosive mixtures, 2021.1
filling tanks, 2021.10-.11
large leaks, 2021.12
leaky containers, 2021.5
precautions preliminary to loading, 0611.4
Gin poles, 0829.4
Glassware, laboratory, 1704
Gloves, rubber, electrical, 1501.2b(1)

REDACTED
J-M 83

2036

MT-PWHD-005646

0008 1328

REDACTED
J-M 83

Governors, pump, 0711.1c-d
pump pressure regulating, 0712
Graders, earth, 0875
Grill, messing, 1907.2m
Grinder, meat, electric, 1905.3b
Grinding wheels, general, 0927
guards, 0927.6
operating, 0927
portable, 1433
Ground returns, arc welding, 1038
Grounding metal parts, 1512
Grounds, fire hazards, 0201.1
personnel hazards, 0201.2
Guards, band saws, wood, 1111.2b
belt, 0717
boring machines, wood, 1117.6
circular resaws, 1110.8a
circular saws, 1110.3a
construction of, 0719
gears and friction drives, 0715
grinding wheel, 0927.6
jointers, 1114.4
lathes, 0915.2
machine tools, 0904
main machinery, 0715-0719
planing and molding machines, 1115.1
portable circular saws, 1110.10
power presses, 0928.2
profile and swing-head lathes, 1115.1
shafting, 0718
shapers and planers, 0917.2
shapers, wood, 1112.12
sprockets, 0716
tenoning machines, 1113.1
universal woodworking machines, 1119.1

H

Hammers, 1408
forge, 0952
power, 1429
Hand planes, wood, 1116
Hand tools, 1401-1418
general precautions, 1402
Handles, tool, insulating, 1501.5
Hatch, cargo, preparing, 0604.1
Hatchets, 1403
Hazard identification system, 2090.2
Health hazards, petroleum fuels, 2020
Hearing conservation, 0215
Hearing protection, aircraft, 0417.4
woodworking, 1108
Heat treating, 0962
Helicopter, starting engine, 0417.3
Hoists, construction, 0830
workmen's, 0830.1i
Hooks, 0824
Hose, fuel, preparation of, 0611.5
Hose, gas welding, 1027
stringing, 1029
Hose, watch, fuel loading, 0612.1
Hot work, definitions, 2070.2
Housekeeping, foundries, 0936
aviation, 0403
garages, 0520
general, 0201-0205
laboratories, 1701.4
machine shops, 0902
photographic laboratory, 1802.3
sawmills, 1125
sewage and water treatment plants, 1221
Hydraulic fluid, fire resistant, 2060
Hydraulic lifts, motor vehicle, 0524.4b
Hygiene, general, 0210-0217
wash and locker rooms, 0217

I

Illumination, general, 0213
recommended levels, 0213.4
Indicator, carbon monoxide, 2078.4
combustible gas, 2078.3
Inert-gas, metal-arc welding, 1039
Insulating floor covering, electrical, 1501.3
Iron, hand, laundry, 1921.5f
puff, tailor shop, 1916.2b

J

Jacks, excavation, 0885
motor vehicles, 0524.4a
Jet assisted take-offs, aircraft, 0425
Jointers, wood, 1114
JP-5 fuel, 2022

K

Ketones, 2055.5
Kettle, steam-jacketed, 1907.2j
Knife, bolo, 1418
Knives, draw, woodworking, 1116
jointer, 1114.1
woodworking, 1105.1

L

Labeling, hazardous materials, 2085-2091
design, 2090
responsibilities, 2087
Labels, hazardous materials, availability, 2089
Laboratories, 1701-1708
Laboratory, equipment, 1703
glassware, 1704
illumination, 1703.2
ovens, 1703.6
Ladder jacks, 0836.21
Ladders, 0835
extension, 0835.6
fixed, 0835.5
metal, 0835.2h
office, 0204.9
step, 0835.7
trestle, 0835.9
use, 0835.3
Lasers, 1550-1556

MT-PWHD-005647

Lathes, 0915
profile and swing-head, 1115
Laundry, equipment, 1921.5
exchange, 1921
Lead, 2057.4
Life preservers, 0621; 0633.1
Life rings, 0620; 0633.2
Lifts, hydraulic, motor vehicle, 0524.4b
Lighting, construction site, 0806
in hangars, 0404
Liquid oxygen, aircraft, 0420
Loaders, excavation, 0883
Locomotive inspection, 0502.1
Locomotive, diesel-electric, 0502.5
internal-combustion, 0502.4
storage-battery, 0502.3
Lumber, piling, construction site, 0810.2

M

Machete, 1418
Machine guards, 0904
Machine, office, 0204.6; 0204.10
Machine shops, 0901-0908
operating precautions, 0907
repairing, machinery, 0906
wiring, 0908
Machine tools, 0915-0928
Machinery, main, 0701-0706
electrical installations, 0705
remotely controlled, 0706
Machinery, rubber making, 0924
Machines, tenoning, wood, 1113
woodworking, 1110-1119
Magnesium alloys, melting and machining, 0961
Mandatory precautions, 0102.2
Mangle, laundry, 1921.5d
Manifolds, portable, gas welding, 1025
Manual handling, materials, 0303
Markings, danger, airfield, 0406.1
closed target, 0406.2
Materials handling, 0301-0304
construction site, 0810
vehicles, 0320-0322
Meat grinder, electric, 1906.4b
Meat saw, power, 1906.4a
Meat slicing machines, 1906.4d
Mechanical handling, materials, 0304
Medical facilities, 1601-1603
Mercury, 2057.5
Mercury, in laboratories, 1708.2a
Mess equipment, use and care of, 1908.1
Messing, facilities, 1907-1910
Metal treatments, 0960-0964
Metals, 2057
Methyl alcohol, 2055.4a
Methyl chloroform, 2055.3b(2)
Methyl ethyl ketone, 2055.5
Methyl isobutyl ketone, 2055.5
Milling machines, 0916
Mobile service/support equipment, passengers on, 0412
Molding, foundry, 0939
Molding machine, wood, 1115
Mortising, machines, 1117
Motor, electric, series-wound, 1519
Motor vehicle operator's qualifications, 0511
Motor vehicles, 0510-0525
backing, 0512.7
definitions, 0510
emergency and safety equipment, 0513
fire extinguishers, 0513.3
fueling, 0514.3; 0525
gears and brakes, 0514.1
overtaking, 0512.5
parking, 0512.8
railroad crossings, 0512.9
repairing, 0524
right-of-way, 0512.6
rules on the road, 0512
safe following distance, 0512.3
safety for riders, 0516
seat belts, 0513.4
servicing, 0524
special types, 0515
speed regulations, 0512.1
towing, 0514.2
traffic control, 0512.10
turning, 0512.4

REDACTED JAN 83

N

Navy exchange, 1902
Nets, safety, steel erection, 0815.4
Nozzles, automatic fuel dispensing, 0525.3

O

Office, machines, 0204.5, .6, .10
safety, 0204
Ordnance, aviation, 0421
Ovens, galley, 1907.2c
laboratory, 1703.6
Oxygen, cylinders, 1022
liquid, aircraft, 0420
Oxygen concentrations, measuring, 2078.2

P

Paint mixing, 1310.1
Paint removal with torch, 1304
Paint storage, 1303
Painters, medical examinations, 1311.1
Painting, general, 1301-1305
Painting procedures, air station, 0415
Paper cutter, photolab, 1802.2
Paving breakers, pneumatic, 0889
Paving and concrete equipment, 0831
Perchloric acid, 1708.2b
Perchloroethylene, 2055.3b(3)
Pest control, 0216
Petroleum fuels, 2010-2022

MT-PWHD-005648

0008 1330

Petroleum naphtha, 2055.1b
Photoflash bombs, 1805.5
Photographic chemicals, 1806
Photographic laboratory, 1802
Photography, 1801-1806
  applicable precautions, 1801
Pickaxes, 1412
Pier inspection, 0603.1
Pile driving, 0890
Pins, drift, 1405.8
Pipe, cutters, 1409
  handling, 1207
  wrenches, 1206
Pipelines, air-compressor, 1215
Pipes, frozen, thawing of, 1212
Pipework, new, 1214
Piping and plumbing, 1201-1217
  in water treatment plants, 1235
  systems, identification of, 1213
  repair, 1208
  work on, 1202
Pits, motor vehicle, 0524.4
Planers, metal, 0917
Planing machines, wood, 1115
Plants, poisonous, 0873
Plastic coatings, 1313
Plastic dusts, 2056.1
Plastics, 2056
Plastics, foamed, 2056.3
Plating shops, aircraft, 0415
Pliers, 1410
Pneumatic rock drills, 1428
Pneumatic tools, 1427
Poles, electric power line, working on, 1533
Portable power tools, 1425-1433
Posting safety precautions, 0103.1
Potassium cyanide, case hardening, 0955
Potassium, metallic, in laboratories, 1708.2c
Potato peeler, 1907.2e
Powder actuated tools, 1431
Power presses, 0928
Precautions, advisory, 0102.2
Precautions, mandatory, 0102.2
Pre-rinsing machine, scullery, 1909.2a
Presses, forging, 0952
Pressing machine, laundry, 1921.5e
  tailor shop, 1916.2a
Pressure cooker, 1907.2k
Pressure vessels, unfired, 0735-0736
Propellant fuels and oxidizers, 2030
Protective clothing, abrasive blasting, 1321
  acids and alkalies, 2005.2a
  arc welding, 1036.3
  asphalt, 0831.3c
  batteries, 1520.1c(1)
  boilers, 0725.3c; 0726.1a
  case hardening, 0955.3
  commissary, 1901.4; 1904.1b
  concrete, 0814.1b; 0814.2g
  construction, 0805
Protective clothing, *continued*
  demolition, 0840.6, .9
  diesel shops, 0507.1c
  dipping, forge shop, 0954.4
  drill presses, 0918.6
  electricity, 1501.2
  electroplating, 0964.3
  forges, 0950; 0953.2
  foundry furnaces, 0940.2, .5
  fuel handling, 2017.4
  garage, 0521
  grinding wheel, 0926.2
  hammers, power, 1429.6
  inert-gas welding, 1039.3
  laboratories, 1702
  liquid oxygen, 0420.5
  machine shops, 0903
  materials handling, 0302
  metal saws, 0920.1
  molding and core making, 0939.1
  painting, 1311.2-5; 1312.3; 1313.2
  photolab, 1802.5
  pickling, 0963
  plumbing, 1204; 1207.1
  poisonous plants, 0873.2
  portable circular saws, 1110.10b
  rust preventive compounds, 1314.4
  sand mills, 0938.1
  sawmills, 1126
  sewage and water treatment plants, 1223
  shapers, 1112.11
  steel erection, 0815.1a-b
  transformers, 1515.1a
  welding, 1010-1011
Pumps, centrifugal, 0711
  main machinery, 0710-0712
  propeller, 0711
  reciprocating, 0710
  rotary, 0711
Punches, 1405.8
Punch presses, 0928
Purpose of publication, 0101

R

Radar, aircraft, 0422.9
Radio frequency circuits, 1542.1
  radiation hazards, 1543.1
    to flammable vapors, 1543.2
    to ordnance, 1543.3
    to personnel, 1543.4
Radioactive materials, 2059
  in laboratories, 1708.1e
  with radiac, 1547
Railroad cars, unloading, 0506
Railroad crossings, motor vehicles at, 0512.9
Railroad engines on turntables, 0507.6
Railroad equipment, limits on riders, 0501.2a
  safety on boarding, 0501.3; 0507
Railroads, 0501-0507
  composition of crew, 0501.1

REDACTED
I-M 83

MT-PWHD-005649

Railroads, *continued*
fire prevention, 0503
operating precautions, 0505
shop safety, 0507
signals, 0504
warning signs in shops, 0507.4
Ramps, excavation, 0886
Ranges, galley, 1907.2c
Rasps, 1407
Receivers, compressed air, 0736
Receiving room, commissary, 1904
Refrigerants, leaks, 0222.3
toxic, 0222.2a
Refrigeration, 0222
Refrigeration plants, safety in, 0222.5
Refrigerator doors, 0222.5f
Refrigerators, commissary, 1906.5
Regulations, changes, 0102.4
Regulators, gas welding, 1024
Reporting, injury, 0103.3e
Reporting, unsafe conditions, 0103.3c
Respiratory protection, sewage and water treatment plants, 1226
welding, 1012
Responsibilities, commanding officers, 0103.1
individuals, 0103.3
supervisory personnel, 0103.2
Riders, motor vehicles, restrictions on, 0516.1
Riggers rules, 0820.5
Riveting, steel erection, 0815.2
Rock crushers, 0831.1
Rock drills, pneumatic, 1428
Rolls, forming, metal, 0925
Roofing brackets, 0836.22
Ropes, 0821
fiber, 0821.1
wire, 0821.2
Rubber gloves, electrical, 1501.2b(1)
Rubber making machinery, 0924
Rules of the road, motor vehicles, 0512
Rust preventive compounds, 1314

S

Safety equipment, sewage and water treatment plants, 1225
Salamanders, 0808
Sanding machines, 1118
disk, 1119.4
drum, 1119.3
Saw, meat, power, 1906.4a
Sawmills, 1125-1127
Saws, hand, 1411
metal, band, 0922
circular, 0921
general, 0920
portable, power, 1432
wood, band, 1111
circular, 1110
inverted swing cut-off, 1110.6
swing and sliding cut-off, 1110.5
Scaffolds, 0836
all-pole, 0836.2
barge, 0836.5
bricklayer's, 0836.6
carpenter's bracket, 0836.19
crawling boards or chicken ladders, 0836.20
definitions, 0836.1a
float, 0836.12
horse, 0836.17
independent pole, 0836.4
interior hung, 0836.13
lumber, 0836.1d
masons' swinging, 0836.14
nails, 0836.1f
needle-beam, 0836.15
outrigger, 0836.16
plasterers', 0836.18
precautions, 0836.1b
rolling, 0836.8
ropes and cables, 0836.1e
safe loads, 0836.1c
single-pole, 0836.3
suspended, 0836.9
suspended stage, 0836.10
tubular pole, 0836.7
window jack, 0836.23
School buses, 0515.1b
Scope of publication, 0102
Scrapers, clearing, 0876
Screwdrivers, 1413
Scullery, 1909
Scythe, 1418
Seatbelts, motor vehicles, 0513.4
Sewage plants, 1220-1235
Sewer maintenance, 1230
Sewer, work, 1203
deep, entering, 1231
Sewing machine, tailor shop, 1916.2c
Shapers, metal, 0917
wood, 1112
Shears, alligator, sheet metal, 0923.2
forge, 0952
hand, sheet metal, 0923.4
squaring, sheet metal, 0923.1
Sheet-metal work, 0923
Shock, electrical, special precautions, 1501.11
resuscitation, 1501.12
Shovels, hand, 1412
power, 0884
Sickle, hand, 1418
Side cutters, 1410
Sight conservation, 0214
Signals, railroads, 0504
Silicosis, 2058.1
Slicing machine, meat, 1906.4d
Sludge holders, purging, 1232
Sodium cyanide, case hardening, 0955
Sodium, metallic, in laboratories, 1708.2c

REDACTED
FOIA 83

MT-PWHD-005650

Solvents, 2055
chlorinated hydrocarbon, 2055.3
paint, 1316
Sonar, hazards to divers and swimmers, 1549
Spades, 1412
Sparks from tools, fuels, 2017.8
Speed limits, ambulances, 0515.2d
fire apparatus, 0515.3c
school buses, 0515.1b(1)
Spotting, drycleaning, 1917.5c
Spontaneous ignition, coal, 2036
petroleum fuels, 2017.9
Spray, booths, 1312.9
painting, 1312
ventilation, 1312.2
Stacking materials, warehouse storage, 0311
Stairs, 0202.6
Static electricity, in fuel handling, 2017.5
Steam engine reciprocating, 0704
Steam lines, breaking flange joints, 1208.8
open ends, 1208.8c
Steamtable, mess, 1908.1a
Steel construction, demolition, 0849
Steel erection, 0815
Stockroom, commissary, 1903
Stoddard solvent, 2055.1a
Storage, chemicals, laboratory, 1707
photographic, 1806.3
coal, 2036
compressed gases, 2045-2046
construction site, 0810
exchange, merchandise, 1903
fuel, petroleum, 2013
paint, 1303
pipe, 1207.3, .4
rope, weight handling, 0821.1c, .2c
warehouse, 0310-0313
Stoves, construction site, 0807.3
Stowage, deck, 0605.4
Straddle trucks, 0322
Switches, electrical, 1514
securing, 1511

T

Tailor shop, exchange, 1916
machines, 1916.2
Take-offs, jet assisted, aircraft, 0425
Tanks, aircraft, fueling, 0411.6
cabin, 0411.9
Tanks, compressed air, 0735
Tanks, fuel, entering, 2020.6
freeing vapor from, 2015.6
storage, 2013
ventilation, 2015.7
gasoline, boat, 0636.4
filling, 2021.10
lead contaminated, 2020.3
sewage and water treatment, 1222
Taxiing, aircraft, 0407.2
Tenoning machines, 1113
Threading dies, hand, 1414
Threshold limit values, 2003.2a
Tire, installation, motor vehicle, 0524.8
Toilet facilities, temporary, 0803
Toluene, 2055.2b
Tolylene diisocyanate, 2056.3
Tool handles, insulating, 1501.5
Tools, forge, 0951
garage, 0523
general, 0203
hand, 1401-1418
live-line, 1525.4c(2)
machine, 0915-0928
plumbing, 1205;1206
pneumatic, 1427
portable power, 1425-1433
powder actuated, 1431
Torches, gas welding, 1026
liquefied petroleum gas, 1217
Towing, motor vehicles, 0514.2
trailers, 0515.4c
Tractors, 0874
Traffic control, motor vehicles, 0512.10
Trailers, 0515.4
Trains, tractor trailer, 0323
Transformers, working on, 1515
Transporting explosives, 0517
Trees, felling and trimming, 0871
Trenches, 0887
Triaryl phosphate, 2060
Trichloroethylene, 2055.3b(3)
Tricresyl phosphate, 2060.1
Trucks and trailers, 0515.4
Trucks, dump, repairs, 0524.3
fork, 0321
straddle, 0322
Tubes, cathode-ray, 1546
electron, containing radioactive materials, 1548
Tumbler, drycleaning, 1917.4f
laundry, 1921.5c
Typewriters, 0204.5

U

Unfired pressure vessels, 0735

V

Valve, safety device, compressed gases, 2041
stems, piping, 1209
Valves, compressed gas cylinders, 2043.2
cylinder, gas welding, 1023
relief, main machinery, 0702
sea, inspection of, 1210
stationary boiler, 0726.4
Vegetable chopper, 1907.2d
Vending machine, mess, 1908.1e
Ventilating equipment, sewage and water treatment plants, 1227

REDACTED

MT-PWHD-005651

0008 1333

Ventilation, buildings, 0212
paint dipping, 1315.2
power boats, 0635.2c
spray painting, 1312.2
welding, 1046-1051
Vessels, pressure, unfired, 0735

W

Warehouse, fire prevention, 0313
Warehouse storage, 0310-0313
Warning signs, abrasive blasting, 1325.1c
acids and chemicals, 2005.1a
aircraft, arresting gear, 0423.2b
catapults, 0424
fueling, 0418.1a
no-smoking, 0402.3b
propellers, 0417.1a
airfield, 0406
coal cars, unloading, 2035.1b
demolition areas, 0841
electricity, 1501.10
excavation, 0881.2
foundry furnaces, 0940.3
garage, 0520.4
heat treating, 0962.3d
high voltage lines, 0809.10c
lasers, 1552.4
motor vehicles, disabled, 0513
paper cutters, 1802.2
radio-frequency, 1541
railroad cars, unloading, 0506.3
railroad shops, 0507.4
road construction, 0831.4f
sewage and water treatment plants, 1229
transporting explosives, 0517.3d
trucks, 0515.4b(4)
Wash and locker rooms, hygiene, 0217
Washer, laundry, 1921.5a
Washing machine, drycleaning, 1917.4c
Watch repair shop, exchange, 1920
Water safety, 0620-0621
Water treatment plants, 1220-1235
Weight handling equipment, 0820-0831
color code, 0820.3o
operator qualifications, 0820.3a
principal accident causes, 0820.2
signals, 0820.4
Welding, aloft, 1003.3
apparatus, 1006
certification of closed compartments, 1054
Welding, *continued*
explosive fumes, 1053
eye protection, 1011
fire extinguishing equipment, 1007
fire watch, 1003.5
galvanized steel, brass, or bronze, 1052
gas, 1020-1029
gas, cylinders, 1020-1021
general, 1001-1007
hazards, 1004
hollow parts, 1005
in confined spaces, 1045-1054
near boatswain's chair, 0836.12b
near needle-beam scaffolds, 0836.15 l
on scaffolds, 0836.1e(9)
on shipboard, 1028
protective clothing, 1010
respiratory protection, 1012
steel erection, 0815.1c
Well drilling, 0891
Wheelbarrows, construction, 0811
Wheels, grinding, portable, 1433
Whetstones and steels, 1415
Wire rope, 0821.2
Woodworking, areas, 1103
defective equipment, 1104
dust control, 1107
general, 1101-1108
machines, 1110-1119
universal, 1119
personnel instruction, 1102
safety equipment, 1106
Wrecking bars, 1416
Wrenches, hand, 1417
power, 1430

X

X-ray, department, medical facilities, 1602
equipment, installation and care of, 1602.2
film, storage of in anesthetic room, 1602.2c
film, storage of, 1602.2d
protection from direct radiation, 1602.3
radiation hazards, 1544
Xylene, 2055.2b

Z

Zinc, 2057.6

REDACTED 83 FOIA

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2042

MT-PWHD-005652

0008 1334

REDACTED
J-M 83

0008 1335

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INDEX TO
SAFETY SUPPLEMENTS

REDACTED
J-M 83

A

Abrasive grinding wheels, 0926
Accidents, investigation and reporting, 0112
Appliances, privately owned, 0220
Antennas, work precautions, 1543
Asbestos, 2058.2

B

Belts, safety, 0651.3
Bicycles, 0515.6
Boat operations, small, 0630
Boilers, chemical cleaning, 0731
Brows, 0650.1
Buffers, 0926

C

Camels, 0650.5
Carbon Dioxide Systems, Fixed Free Flooding, 0653.4
Circuit breakers, 1500
Circuits, energized, working on, 1500
Clothing, 0114.1
Coffee making equipment, 0220
Committees, 0110, 2087.1
Compressed air systems, 0737
Confined spaces, working in, 2071
Craft, not-in-commission or service, 0652.2
Cranes, 0825

D

Deaths, investigation and reporting, 0113
Diving, sonar hazards, 1549.1
Drydock filling and discharge tunnel entrances, 0650.1
  services and controls, identification and location, 0650.13
  elevators, 0830
Dumbwaiters, 0221

E

Ear protection, 0114.5
Electric equipment, portable, 1500

2043

MT-PWHD-005654

REDACTED
J-M 83

Electrical services, temporary, 0650.4
Electricity, 1500
Elevators, 0221
    drydocks (workmen's hoists), 0830
Escalators, 0221
Eye protection, 0114.4

F

Fire Alarm boxes, 0205.4
Fire Bill, shipboard, 0653.1
    shipyard, 0205.1
Fire fighting equipment, emergency portable, 0205.5
Fire in machinery spaces, precautions, 0653.3
Fire prevention, responsibilities, 0205.2
    training for shipboard hot work, 0653.6
Fire regulations, 0205.3
    Pier 4 special regulations, 0653.5
Fire squads, shop or office, 0205.6
Fire watch instructions, shipboard, 0653.2
Floats, 0650.5
Flooding Bill, shipboard, 0652.5
    shipyard, 0652.6
Flooding, decommissioned ships, 0652.3
    ships in commission, 0652.1
    Planning Department procedures, 0652.4
Foot protection, 0114.3
Forklifts, 0321

G

Gas free engineering, 2072

H

Hazardous material control, 2090
Head protection, 0114.2
Hearing conservation program, 0114.5
Hoists, workmen's, 0830
Hoses, placement aboard ship, 0651.1
Housekeeping, 0201
Hydrostatic testing, 0730

I

Inspection, weekly shipboard safety, 0650.10
Installations, shipboard safety, 0651.2

J

MT-PWHD-005655

K

L

Labeling Hazardous material, 2090
Lead processing, 2057.4
Licensing, operator, materials handling equipment, 0320
  motor vehicle, 0511
  weight handling equipment, 0820
Lighting, temporary shipboard, 0650.3
Lines, safety belt, 0651.3
  utility and service, 0651.1

REDACTED
J-M 83

M

Medical treatment of occupational injuries and illnesses, 0111
Motorcycles, 0515.6
Motor vehicle safety program, 0510

N

O

P

Paint, organo-tin, precautions when using, 1311
Painting ships external hulls, 1313
Passenger safety, 0516
Personnal protective equipment, general requirements, 0114
Pier 4 special fire regulations, 0653.5
Pier services and controls, identification and location, 0650.12
Pipe joints, breaking, 1208.8
Pumps, high pressure hydraulic, 0713
Punts, o650.5

Q

R

Radar transmitters, work precautions, 1543
Radiological safety, 2059.1
Respiratory protection, 0114.6
Rubber gloves, 1500

S

Safety program objectives, 0103
  policy, 0103
  responsibilities, 0103
  scope, 0103

REDACTED
J-M 83

Sandblasting, 1320
Sanding discs, 0926
Scaffolds, 0836
Scaffolding barges, 0650.5
Scooters, 0515.6
Sea trials, 0650.8
Ship Safety Audit, quarterly, 0650.11
Ships not in commission or service, 0652.2
Shoes, 0114.3
Sight conservation program, 0114.4
Signs,accident prevention, 0116
Solvents, hazardous, 2055
Sonar domes, pressurized rubber window, 1549.2
Spreaders, 0650.5
Storms, precautions against, 0650.9
Supplemental safety regulations, sources, 0102.3
Switches, electrical, 1500

T

Tags, danger, 0115
Tagging electrical equipment, 1500
Tanks, opening and closing, 2071
Training, fire prevention for shipboard hot work, 0653.6

U

V

Valve bonnet joints, breaking, 1208.8

W

Water, fresh, shipyard system, 0210
Water connections, ship to shore, 0650.2
Weapons systems testing, shipboard, 0650.7
Weight handling equipment, general regulations, 0820
Welding operations, oxygen and acetylene, 1020
    precautions for zinc, 1004.2
Wire wheels, 0926

X

Y

Z

Zinc, welding precautions, 1004.2

MT-PWHD-005657

0008 1339

REDACTED
J-M 83



RESUPSHIP



2047

MT-PWHD-005658

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

TABLE OF RESUPSHIP
SAFETY SUPPLEMENTS

RESUPSHIP SUPPLEMENT	SUBJECT
0100	Safety Program Policy and Responsibilities
0104	Personal Protective Equipment
0105	Emergency Situations
0650.1	Ammunition and Hazardous Substance
0650.2	Sea Trials
0650.3	Marine Collisions and Casualties
0650.4	Oil Spills
0652	Flooding
0653.1	Fire Protection
0653.2	Fixed Carbon Dioxide (CO_2) Systems

REDACTED J-M 83

2048

MT-PWHD-005659

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RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0100

Subj: Safety Program Policy and Responsibilities

Ref: (a) LBNS Safety Supplement No. 0112

1. POLICY. The policies, objectives and safety requirements of the RESUPSHIP LBEACH Safety Program are basically the same as those of the Long Beach Naval Shipyard. Accordingly, Long Beach Naval Shipyard supplemental safety instructions (the green sheets of this manual) are applicable to RESUPSHIP operations and will be adherred to by all personnel. In addition, all personnel will comply with the supplemental instructions included in this section of the Safety Manual to cover differences between RESUPSHIP and LBNS operations (yellow sheets).

2. RESPONSIBILITIES

a. RESUPSHIP. The Resident Supervisor of Shipbuilding, Conversion and Repair, USN, Long Beach, has overall responsibility for the safety and occupational health of all military and civilian personnel under his jurisdiction.

b. Assistant RESUPSHIP is responsible to the Commanding Officer for management of the accident prevention program.

c. Quality Assurance/Safety Officer is responsible to the Commanding Officer for Navy safety at contractors' yards. He will conduct all necessary accident investigations and prepare all reports required by reference (a). The LBNS Safety Division (Code 185) will be provided copies of all reports and, in addition, other information/data as may be requested. Reports which will be provided Code 185 include but are not limited to the following:

(1) Accidental Injury/Death Report (OPNAV Form 5100/1)

(2) Shore Accident/Near Accident Damage Report (OPNAV Form 5100/2)

(3) Official Superior's Report of Injury (CA-2)

(4) Disabling Work Injury Reports

(5) Quarterly Accident Data Report (NAVEXOS Form 110)

(6) Quarterly Report of Federal Occupational Injuries and Illnesses (OPNAV Form 5100/5)

d. LBNS Safety Division (Code 185) will process all injury compensation cases and will submit required accident reports and information to appropriate non-activity agencies.

2049

MT-PWHD-005660

e. Management Responsibilities. Each supervisor is responsible for assuring that every employee under his supervision is thoroughly acquainted with safety rules, regulations, procedures, practices, and that they are enforced; insuring that his subordinates are provided with the proper type of safety equipment for each specific job assigned; and, if necessary, personally demonstrating the safe procedures for the job; eliminating existing hazards and unsafe practices; investigating accidents to determine the basic cause and taking necessary steps to prevent a recurrence. He will also take appropriate action when violations of safety regulations are brought to his attention.

f. Individual Responsibilities. Employees will observe all safety regulations and rules established in this manual, OSHA Standards, and by contractors during the conduct of assigned or delegated responsibilities and report unsafe practices or conditions to his immediate supervisor or other recognized authority for appropriate action.

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J-M 83

MT-PWHD-005661

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0104

Subj: Personal Protective Equipment

Ref: (a) LBNS Safety Supplement No. 0114.2
(b) LBNS Safety Supplement No. 0114.3
(c) LBNS Safety Supplement No. 0114.4
(d) LBNS Safety Supplement No. 0114.5

1. PURPOSE. To supplement references (a) through (d) with additional instructions applicable to employees of RESUPSHIP LBEACH.

2. HEAD PROTECTION. All employees are required to wear protective helmets (hard hats) when duties are within contractors' yards, drydocks, on board ships, piers or in areas where the hazards of falling objects normally exist. Protective Helmets will be issued from the Safety Issue Room, westside of Building No. 132, Long Beach Naval Shipyard, in accordance with the procedures established in reference (a). The color designation for RESUPSHIP hard hats is Suntan, Navy Color Code No. 11.

3. FOOT PROTECTION. Protective footwear (Safety Shoes) will be worn while in toe-hazardous areas of contractors' yards (casual visits excepted). Reference (b) delineates areas and work operations considered to be toe-hazardous, as well as types of protective footwear and methods of procurement.

4. EYE PROTECTION. All personnel shall wear approved safety eyewear, plano or prescription, when entering or working in eye-hazardous areas or exposed to eye hazardous processes, whether so employed regularly or periodically. Visitors are included in this requirement whenever similarly exposed. Reference (c) delineates eye hazardous areas and processes, as well as the procedures for procurement and disposition of protective eyewear.

5. HEARING PROTECTION. Hearing protective devices will be worn while in high noise level areas. In general, when it is difficult to hear a loud spoken voice at a distance of one (1) foot, a high level of noise exists and hearing protective devices should be worn. Hearing protective devices are obtained at the Naval Regional Medical Center Dispensary, Long Beach Naval Shipyard in accordance with procedures outlined in reference (d).

REDACTED
J-M 83

2051

MT-PWHD-005662

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0105

Subj: Emergency Situations

1. PURPOSE. To delineate necessary action to be taken in the event of an emergency.

2. DEFINITION OF EMERGENCY. The term "emergency" is defined as including but not necessarily limited to the following:

a. Fire.

b. Flooding.

c. Collisions.

d. Explosions.

e. Loss of life, or injury to ship's or contractor's personnel.

REDACTED
83

3. ACTION. Any and all emergencies involving personnel, military and civilian, will be immediately reported to the Duty Officer. In addition, the following actions will be taken:

a. During Regular Working Hours. During regular working hours, the cognizant Assistant Repair Officer shall be notified. If necessary, he will make his presence known to and advise the Commanding Officer that he is available to lend any possible assistance including assistance from contractor personnel on a voluntary basis. He shall notify the Quality Assurance/Safety Officer (Code L300) who will:

(1) Make an on-the-spot survey and inspection to determine the probable cause of the casualty and extent of the damage.

(2) Solicit, but not demand, information from the Commanding Officer or the Officer-in-Charge and/or contractor's personnel.

(3) Make a written report to the Resident Supervisor outlining extent of damage and probable cause as determined by on-the-spot survey.

(4) Conduct a thorough investigation of the casualty and make a written report to the Resident Supervisor when the situation warrants.

b. Outside of Regular Working Hours. In case an emergency situation arises outside of regular working hours on a ship undergoing availability under the cognizance of the Resident Supervisor of

2052

MT-PWHD-005663

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

Shipbuilding, Conversion and Repair, USN, Long Beach, the Duty Officer shall notify:

(1) Resident Supervisor

(2) Assistant Resident Supervisor

(3) The cognizant RESUPSHIP Project Office

(4) Quality Assurance/Safety Officer (Code L300).

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J-M 83

2053

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J-M 83

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0650.1

Subj: Ammunition and Hazardous Substance

Encl: (1) Off-loading Guidance Summary
(2) Sample Format Letter Reporting Inventory of Ammunition Retained Aboard Ship

1. PURPOSE. This supplement promulgates ammunition safety regulations to be observed and prescribes the requirements governing the off-loading of ammunition and hazardous materials from ships prior to accomplishment of industrial work.

2. DEFINITIONS.

a. Ammunition. Applies to all components of any explosive in any case or contrivance to form a charge, a complete round, cartridge for cannon or small arms, or for any other weapons, torpedo warhead, mine, bomb, depth charge, demolition charge, fuse, detonator, projectile, all signaling and illuminating pyrotechnic material, all rocket ammunition, all chemical warfare materials and all solid and liquid propellant under the cognizance of the Bureau of Naval Weapons.

b. Hazardous Substance. Means a substance which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritant or otherwise harmful is likely to cause an injury.

c. Hot Work. Means riveting, welding, burning or other fire or spark producing operations.

d. Enclosed Space. Means any space other than a confined space, which is enclosed by bulkheads and overhead.

e. Exterior Boundary. Means the outer face of a plate surrounding a space or any metal structure immediately adjacent thereto.

3. SAFETY PRECAUTIONS. The following safety precautions are to be followed on all ships assigned availabilities under RESUPSHIP LBEACH:

a. When appropriate, all ships assigned availabilities to RESUPSHIP LBEACH will be advised by message by cognizant Project Officer to remove ammunition and other hazardous materials prior to entering contractors' yards in accordance with the following criteria (see enclosure (1) for further guidance):

(1) For regular, interim and FRAM overhauls, ships shall off-load all ammunition and other hazardous materials, except for sufficient small arms ammunition for security purposes.

MT-PWHD 005665

0008 1347
REDACTED
J-M 83

(2) For restricted availabilities of more than three weeks requirements of regular overhauls shall apply.

(3) For restricted availabilities of three weeks and less, ships shall off-load all black powder, pyrotechnics, detonators and similar material and shall strike all other ammunition below main deck in floodable magazine spaces. In addition, when drydocking is involved, ships shall off-load bomb type ammunition or any other ammunition in way of possible hot work.

b. It will be considered safe to accomplish hot work on board a ship which has ammunition and explosive materials aboard provided the ammunition and/or other hazardous substance is separated by one compartment, tank or void (two bulkheads or two decks), a minimum of 20 feet and the work will not result in heating the exterior boundry surface of the separated compartment, tank or void. The intervening compartment tank or void must be certified "gas-free" and "safe for hot work" according to the following criteria:

(1) Any compartment, tank or void in which welding is to be performed must be certified "gas-free" and "safe for hot work."

(2) When welding must be performed on a compartment boundary, it is considered that hot work is being performed in all compartments separated by the boundary and all such compartments must be certified "gas-free" and "safe for hot work."

(3) When only one compartment, tank or void separates the location of hot work from ammunition or hazardous substance, then the separating compartment(s) must be certified "gas-free" and "safe for hot work."

4. ACTION. Strict compliance with safety precautions is essential to minimize the dangers from fire or explosions when working with ammunition or other hazardous substance aboard. The precautions applicable to hot work shall apply to all other sources of flames, sparks, or intense heat, such as lighted cigarettes, open flame or electric heating apparatus, explosive proof lights and electric motors. The following minimum safety precautions are prescribed in all cases and special precautions will be directed in individual cases:

a. Commanding Officers of ships shall insure that:

(1) All ammunition is properly stowed and remains stowed in floodable magazines below the main deck or hanger deck and that handling, restowage, testing, sampling, loading, off-loading or related operations are not conducted during the availability. (This does not preclude routine on-board surveillance in accordance with OPNAVINST 8020.8 (series).)

MT-PWHD-005666

REDACTED
J-M 83

(2) While hot work is in progress, one fire watch is stationed in the space in which the hot work is being performed, one fire watch is stationed in the separating compartment, tank or void (if practicable) and one fire watch is stationed at the remote control flooding (sprinkling system) valve for each magazine concerned; all fire watch personnel are equipped with full CO_2 extinguishers and have a working knowledge of the sprinkling system; firemain is pressurized and nearby fire hoses connected and ready for use; fire watch conducts a periodic inspection of affected spaces for a period of four hours after completion of hot work.

(3) All ships' force personnel are aware that ammunition has been retained on board and are instructed in the necessary safety precautions.

(4) Authorized relocation of ammunition or hazardous substance at Naval Station piers is supervised by a competent officer who is familiar with the standard safety precautions and the contents of this Instruction. No hot work is authorized to be accomplished during relocation.

b. The Project Officer through the cognizant Project Coordinator shall:

(1) Issue ammunition and hazardous substance requirement message prior to each ship availability when appropriate.

(2) Upon receipt of work requests from ships under availability for hot work closer to ammunition or hazardous material than permitted by paragraph 3.b, request cancellation of work request or off-loading of ammunition or hazardous substance in an authorized handling area.

(3) Advise the Commanding Officer to provide RESUPSHIP LBEACH with status report of ammunition on board when ship arrives or at commencement of availability. (See enclosure (2) for guidance.) This information should be provided to appropriate Departments.

c. The Planning Department shall insure that job orders and supplements which involve hot work in close proximity to ammunition and hazardous substance state "Ammo Aboard" and specify certification before hot work is required.

d. The Quality Assurance Officer shall insure:

(1) All RESUPSHIPLBEACH inspectors concerned with assigned ships and inspection work are thoroughly familiar with the contents of this Instruction and are aware when a ship contains ammunition or other hazardous substance that may restrict work.

MT-PWHD-005667

(2) The RESUPSHIPLBEACH Quality Assurance Representatives are instructed to require strict adherence with certification required prior to commencement of hot work.

(3) That no work is accomplished unless work instructions comply with ammunition safety regulations outlined in this Instruction. (Hot work is not to be ordered or performed in any location until it us ascertained that such hot work area has been inspected and certified "safe for hot work" by a Maring Chemist and the requirements of paragraph 3.b are met.)

(4) That areas certified "Unsafe for Hot Work" by Marine Chemist will be tagged. If tagged during working hours, the RESUPSHIP Quality Assurance Representative will notify cognizant Assistant Repair Project Officer and Coordinator and the ship's Commanding Officer, or if tagged outside the regular day shift, will notify the RESUPSHIP Duty Officer, the ship's Commanding Officer or Duty Commander.

(5) That no hot work is performed during the transfer of ammunition, within or alongside the pier.

(6) That no ammunition is transferred when ship is berthed at a private shipyard.

REDACTED
J-M 83

OFF-LOADING GUIDANCE SUMMARY

	Bomb Type Torpedo & Guided Missile Warheads, mines, depth charges, general purpose bombs, special weapon activators, cast demolition blocks	Gun Type Case, cartridge cannon including large quantities of small arms ammo	Black Powder Pyrotechnics Signalling, Illuminating	Small Arms For ship's security	Cargo Ammunition	Hazardous Material Gasoline, Jet fuel, Lethal gases, flammable	Special Weapons
Conditions for Regular, Interim & FRAM Overhaul, or restricted availability of more than three weeks	OFF-LOAD PRIOR TO ENTERING AVAILABILITY			Retain on board if CO desires	OFF-LOAD PRIOR TO ENTERING AVAILABILITY		
Condition for restricted availability of three weeks or less	Normally off-load	Normally Retain	Off-load	Normally Retain	Off-load	OFF-LOAD EXCEPT IN EXTREME EMERGENCY	
Conditions for dry-docking during a restructed availability	Off-load		Off-load		Off-load	Off-load	Off-load

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J-M 83

RESUPSHIPLBEACHINST 5100.27C
October 1973

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Enclosure (1)
(Reverse Blank)
0650.1-5 2058

MT-PWHD-005669

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

SAMPLE FORMAT LETTER REPORTING INVENTORY OF AMMUNITION RETAINED ON BOARD

From: Commanding Officer, U.S.S. _____
To: Resident Supervisor of Shipbuilding, Conversion and Repair, USN, Long Beach, California

Subj: Inventory of ammunition retained on board

Ref: (a) RESUPSHIP LBEACH _____

Encl: (1) Inventory of ammunition retained on board

1. In accordance with the provisions of reference (a), enclosure (1) is submitted listing magazines containing ammunition other than small arms to be retained on board during the ship's availability at RESUPSHIP LBEACH from _____ to _____.

2. Ammunition will remain stowed in magazines equipped with sprinkling systems. Ammunition which cannot be stowed in magazines such as torpedoes and depth charges will have increased surveillance and security imposed. Boosters will be removed and firing mechanisms locked.

3. No ammunition or other hazardous substance will be moved while under availability without permission of the RESUPSHIP LBEACH.

_____
(Signature)

REDACTED
J-M 83

Enclosure (2)
(Reverse Blank)
0650.1-7

MT-PWHD 005670

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0650.2

Subj: Sea Trials

1. GENERAL. All personnel embarked in a U. S. Navy ship undergoing sea trials or other authorized mission at sea are under the control and direction of the Commanding Officer. In the event of a major emergency or casualty while so embarked, coordinated action of RESUPSHIP/Contractor personnel is necessary. Such action will be as directed or required by the Commanding Officer or his designated representatives, coordinated by the senior RESUPSHIP/Contractor Representatives on board.

2. PRIOR TO EMBARKATION. The cognizant RESUPSHIP Quality Assurance Representative shall prepare a muster list of all RESUPSHIP personnel (officer and civilian) who are to be embarked on ships under availability construction at this Activity.

3. UPON EMBARKATION. The senior RESUPSHIP Officer and/or RESUPSHIP/Contractor Representatives shall report to the ship's Commanding Officer or his designated representative and present him with the muster list of all RESUPSHIP/Contractor personnel who are embarked on the ship. In addition, the following shall also be accomplished:

a. Request information regarding designation of mustering stations in case of emergency or casualty; designation of abandon ship stations including location of life jackets and life boats available to RESUPSHIP/Contractor personnel; and such other instructions as the Commanding Officer deems necessary.

b. Brief personnel (RESUPSHIP and Contractor) concerning the instructions received from the Commanding Officer.

c. Instruct personnel (RESUPSHIP and Contractor) to assist as practicable on request but not to cause unwarranted interference with the ship's force in the performance of their emergency duties and assignments.

4. BOARDING OR LEAVING SHIPS. RESUPSHIP/Contractor personnel shall not board or leave any ship until it is properly secured. The Commanding Officer of the ship or his delegated representative will determine when the ship is properly secured.

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MT-PWHD-005671

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

REDACTED

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0650.3

Subj: Marine Collisions and Casualties

1. DISCUSSION. To protect the interest of the Government in subject instance, it is vital that the District Admiralty Office (Legal Officer) be immediately notified in each case of collision or other marine casualties involving naval vessels or property and private vessels, property or persons, when such naval vessel has been assigned an availability under the cognizance of the Resident Supervisor of Shipbuilding, Coversion and Repair, USN, Long Beach, California. COMELEVEN Instruction 5880.1 (Series) provides a listing of various situations for which the Legal Officer should be immediately notified of occurrence.

2. NOTIFICATION.

a. An immediate telephone report of subject casualty will be made to the Resident Supervisor of Shipbuilding, Conversion and Repair, USN, Long Beach, CA, cognizant Project Officer and the Contract Officer. Unless otherwise directed, the Contract Officer will call the District Admiralty Officer and advise him of the circumstance.

b. The Project Officer will follow-up this telephone report with a confirming memorandum setting forth the circumstances and actions. This report shall be made to the Contract Officer, copy to Code 100.

3. REPORTS. Report Symbol OPNAV 3040-1 has been assigned to the Report of Casualties.

2061

MT-RWHD-005670

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0650.4

Subj: Oil Spills

1. NOTIFICATION. The responsibility for taking positive action in the event of an oil spill rests with the Commanding Officer of a ship. SOPA Instructions require prompt notification to the Port Service Officer. Any person detecting a spill should notify personnel of the ship concerned and appropriate private shipyard management personnel. Also, notify the cognizant Quality Assurance Department Representative.

2. COURSE OF ACTION. After notification of responsible personnel in accordance with paragraph 1., make self available to lend any possible assistance. Oil spills occuring in private shipyards are usually cleaned up by commercial concerns under contract.

REDACTED
J-M 83

2062

MT-PWHD-005673

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0652

Subj: Flooding

Ref: (a) LBNS Safety Supplements 0652 Series

1. Reference (a) contains precautionary procedures necessary for the prevention of accidental flooding of ships and craft. These procedures will be followed at contractor yards when applicable.

REDACTED
J-M 83

RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0653.1

Subj: Fire Protection

Ref: (a) NAVFAC P-309, Color for Naval Shore Facilities
(b) Federal Standard No. 313, Symbols for Packages and Containers for Hazardous Chemicals and Materials
(c) U. S. Department of Labor Safety and Health Regulations for Ship Repairing, 29 CFR 1915
(d) U. S. Department of Labor Safety and Health Regulations for Ship Building, 29 CFR 1916
(e) U. S. Department of Labor Safety and Health Standards, 29 CFR 1910

Encl: (1) Safety Precautions to be observed while aboard Inactive Fleet Ships

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I-M 83

1. GENERAL. Master Ship Repair Contract holders and New Construction Contractors are required to assure that a comprehensive and effective fire prevention and fire fighting system be employed during any ship work they undertake. Since there is a great variance in the size of shipyards involved and the facilities they possess, it is important that all RESUPSHIP Quality Assurance Representatives have a knowledge of the fire fighting equipment and facilities available in the yard, as well as support activities.

2. DEFINITION. Fire Protection includes everything relating to the prevention, detection and extinguishing of fire. It covers both the safeguarding of human life and the preservation of property. Fire Protection refers to the methods of providing for fire control or fire extinguishment.

3. RESPONSIBILITIES

a. The Contracts Officer is responsible for determining that all Contractors have adequate plant facilities, including fire protection, and appropriate liability insurance when required under the terms of the Master Ship Repair and New Construction Contracts. The facilities shall be inspected periodically by the Property Administrator and the Safety Officer together with technical assistance as desired to determine their adequacy. If any deficiencies are found they shall be promptly brought to the attention of the Contractor and the Contracts Officer. Local Coast Guard and/or cognizant city fire department regulations shall be used as guides in determining adequacy of facilities and protection.

b. The Planning Department is responsible for including appropriate articles in the specifications to provide for adequate fire protection. This shall include but not be limited to number of brows, firemain pressure and volume requirements, fire trees and manifolds to be put aboard, temporary alarm system, etc. At the arrival conference, the

2064

MT-PWHD-005675

Project Coordinator shall discuss with the Commanding Officer, the means of keeping the fire alarm system and the MC in operation and the need for issuing specifications to the Contractor to provide for temporary systems in the event that the ship's systems will be inoperative. This Instruction shall be used as a guide whenever practicable.

c. The Quality Assurance Department is responsible for ensuring that the Contractor uses safe practices at all times. The assigned RESUPSHIP Quality Assurance Representative and Contractor Representative shall meet the ship on arrival in the contractor's yard and discuss local fire alarm systems and posting of emergency telephone numbers at the quarterdeck. The RESUPSHIP Quality Assurance Representative shall ensure that the provisions of the specifications for fire fighting equipment are adhered to and shall not let the Contractor inactivate any system without prior approval of the ship's Commanding Officer. This Instruction should be used as a guide, whenever feasible, by ship's force in establishing adequate fire procedures and protection on board ship by the contractor's personnel. Local Fire Departments and U. S. Department of Labor regulations shall be binding as a minimum requirement. The Quality Assurance Representative shall be cognizant of the adequacy of the ship's fire fighting equipment and notify the Commanding Officer of any deficencies. Violations shall be promptly reported to the Contractor or ship's force as appropiate and all work stopped when the safety of the ship is jeopardized. In the event the discrepancy is major and/or is not corrected immediately, the assigned RESUPSHIP Quality Assurance Representative shall immediately notify the Quality Assurance/Safety Officer (Code L 300).

4. FLAMMABLE LIQUID

a. If the stage of conversion or repair is such that the ship's tanks cannot be used for temporary stowage of flammable liquids, temporary containers will be located on barges or piers adjoining the ship. (If located on piers, such temporary containers shall be clear of cranes, sheds, etc., in order to allow free access in event of casualty.) Such temporary containers shall be surrounded by a coaming of sufficient height to contain the contents of the container in the event of a leak or rupture. Such temporary containers shall be painted brilliant yellow (Federal Color 135838) with contents indicated in block letters in accordance with reference (a). Fueling of "day tanks" and other permanent tanks aboard ships shall be done in accordance with NAVSHIPS Technical Manual, Chapter 9550.

b. Whenever it is necessary to bring a substantial quantity of any flammable liquid on board ships via portable containers for any purpose, the Contractor shall observe the following precautions:

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J-M 83 2065

MT-PWHD-005676

(1) Label hazardous materials with same labels which are issued for ultimate use at the local activity. Included is the labeling of the original container and any other container to which the material may subsequently be transferred. (In accordance with reference (b).)

(2) Provisions shall be made to confine to a small area any spillage which might occur by reason of rupture of the containers during handling.

(3) Adequate physical protection shall be given to the container while stowed on board the ship.

(4) A fire hazard zone shall be designated and plainly marked around the container stowage areas.

(5) Appropriate fire fighting equipment and material shall be at hand in the vicinity of the fire hazard zone.

(6) Quantities shall be limited to that necessary to satisfy the immediate requirements.

(7) It should be removed as soon as it has served the purpose for which it was brought aboard.

c. The Planning Department shall ensure appropriate job order specifications are issued to the contractors in all instances where the contractor will be required to take extra precautions concerning flammable liquids over those required by local Coast Guard, City or Harbor Department directives and U. S. Department of Labor.

5. WOOD BUILDING FOR OFFICES, TOOL ROOMS, ETC., INSIDE OF SHIPS.

a. The use of wooden structures for offices, tool rooms, etc., inside of ships undergoing repair or conversions shall not be permitted without specific authorization of the Quality Assurance/Safety Officer. Where such buildings are required, they shall be built of fire retardant treated wood or fire resistant materials and protected by a sprinkler system. Such facilities, if required, will be provided topside of ship or on the pier.

b. The Planning Officer shall ensure appropriate job order specifications are issued to the contractor for all temporary structures put aboard ship for the convenience of the Government.

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MT-PWHD-005677

6. OVERHEAD STAGING INSIDE SHIPS.

a. Overhead staging inside a ship shall be laid out with due regard to the possible need for fighting a fire on the upper side of the planking with a stream of water directed from below. The staging shall have more than one access from below (whenever feasible). The staging shall not be left in place longer than necessary.

7. WOOD FIRE RETARDANT INSIDE A SHIP.

a. All significant quanties of wood used aboard the ships by contractors shall be treated to make it fire retardant. All staging used inside and in the vicinity of the ships must be treated. Smaller quantities of wood such as damage control plugs and minor amounts of shoring need not be treated.

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8. TEMPORARY ALARM SYSTEMS.

a. Whenever the contractor disables a ship's interior communication system for repair or replacement, he shall immediately provide a temporary alarm system. He shall maintain that system until the ship's permanent alarm system is restored, activated, inspected, and accepted by the Quality Assurance Officer. Standard signals shall be established to cover:

(1) Evacuation of the ship.

(2) Cessation of all welding, burning and other hot work and smoking.

b. The RESUPSHIP Quality Assurance Representative shall ensure the contractor installs all alarm systems as soon as practicable after productive work starts. In announcing systems and general alarm systems, where practicable, the contractor's personnel shall be indoctrinated in the use of the temporary systems.

9. MATING ADAPTERS AND SPANNER WRENCHES. The RESUPSHIP Quality Assurance Representative shall ensure that the contractor furnishes suitable adapters and spanner wrenches for mating shipboard fire fighting equipment (hoses and nozzles) with the shipyard fire equipment. All such adapters and wrenches must be readily available.

10. FIRE FIGHTING SYSTEM REPAIRS.

a. The Department shall ensure that the job order specifications include quantities, type of equipment and locations aboard the ship of temporary fire fighting equipment in the event that the ship's or craft's

MT-PWHD-005678

systems and equipment are inactivated. If the vessel's fire main is inactivated due to repairs specificied, sufficient temporary fire sections will be installed with hose and fittings to reach any point aboard with not more than one hundred feet of hose. The schedule of events shall specify the completion of repairs to fire fighting systems.

b. The RESUPSHIP Quality Assurance Representative shall ensure that the ship has adequate fire protection as required in the specifications at all times. In the event that the ship's equipment and/or contractor's installations are not considered adequate, the Commanding Officer and/or the Quality Assurance Officer shall be notified immediately by the RESUPSHIP Representative assigned to the ship. If the situation is not immediately rectifiable, the Quality Assurance Officer shall report the circumstances to the Contracts Officer and the appropriate Project Coordinator.

11. INDUSTRIAL FIRE PREVENTION. The RESUPSHIP Quality Assurance Representative shall give attention to fire prevention and adequacy of Contractor and ship's equipment which shall receive constant attention during all phases of the overhaul and conversion of ships and crafts. All deficiencies shall be called to the attention of the Commanding Officer of the ship or craft and Contractor by the RESUPSHIP Quality Assurance Representative. Fire prevention and local procedures shall be discussed with all ships and craft on their arrival at the Contractor's yard at the arrival conference.

12. OVERALL FIRE PREVENTION. The Contracts Officer shall issue appropriate job orders to the Contractor, specifying the fire fighting system requirements.

a. Manned. The Commanding Officer, Officer-in-Charge or Petty Officer-in-Charge is responsible for the fire prevention of the ship or craft at such times as the ship's fire fighting ability remains operative. While the ship is in drydock or on a marine railway, the Contractor shall provide full fire fighting capabilities.

b. Unmanned. The Contractor shall be given the responsibility of fire prevention of all unmanned ships, crafts and boats.

13. ACCESS TO AND FROM THE SHIP

a. Job order specifications shall provide for access to vessels in accordance with provisions of Sections 1915.44 and 1916.44 of references (c) and (d).

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b. All requests to board ships in the Naval Inactive Ship Maintenance Facility must be approved by the Department Head or his authorized representative. Personnel will be logged in and logged out when the visit is completed.

c. The "buddy system" will be used. Supervisors will assign personnel in pairs when visits to inactive ships are required.

d. All personnel boarding inactive ships or crafts will be required to read and sign a copy of enclosure (1), copies of which are available from Code L300.

14. STOWED MATERIAL. The Contractor and RESUPSHIP Quality Assurance Representative shall verify that materials are kept clear of restricted areas such as passageways, around hatches, etc. and where stowed in larger areas, they are arranged to provide a natural orderly flow of traffic through wide aisles. This is of primary importance in expediting the removal of personnel from the ship during fire and for proper access to the ship for fire fighting purposes. A third benefit stems from the fire breaks created by wide aisles in areas where the stowage of materials cannot be avoided. (Material in the sense used here is interpreted to include equipment, staging, bins and shelving.) Access lanes on the pier to and from the ship shall be kept open at all times to permit commercial fire trucks to aid the ship or craft in an emergency. A Contractor shall provide suitable precaution cards and post them in conspicuous places on or near any equipment or material which offers a hazard to the security of the ship or the safety of personnel. Such warning signs shall be posted whenever precautions are necessary for the safe handling, stowage and security of dangerous materials such as ammunitions, explosives, or flammables in accordance with section 1910.145 of reference (e). Warning signs shall be posted whenever conditions of a hazardous nature are known to exist. Conditions which would prohibit smoking or welding, the presence of toxic or explosive vapors, acids or caustics, high voltage lines, breathing air supply lines, and radioactive materials are examples of conditions which would require the posting of warning displays. Posting will be augmented by the familiarization of personnel with reference (b), labels containing symbols for "Packages and Containers for Hazardous Industrial Chemicals and Materials" and the "Enforcement of these Safety Precautions." Contractors must notify ship and RESUPSHIP Quality Assurance Representative of location and duration of hazards in advance and keep information current.

15. MATERIAL AND EQUIPMENT UNCRATING. In general, equipment and materials should be uncrated off the ship. If this is not practicable then the crates should be removed from the ship expeditiously after uncrating. Full skip boxes should be removed from the ship as soon as practicable. Prompt removal from the ship of all combustible materials is essential for fire protection.

MT-PWHD 005680

16. OXYGEN AND FUEL GAS SYSTEMS. The RESUPSHIP Quality Assurance Representative shall ensure oxygen and fuel gas systems are capable of being secured by a single pier side valve, preferably at the head of the pier. On portable oxgen fuel gas systems, individual cylinder valves must be shut off at all times when not in use. It is essential that ships' and contractors' personnel know how to operate the valves. All manifolds and long hose line runs shall be kept clear of the deck. Open fuel gas and oxygen hoses shall be immediately removed from enclosed spaces where they are disconneted from the torch or other gas consuming device. (Subpart D of reference (c) provides necessary guidance.)

17. HOT WORK. Before any welding, burning or other "hot" work is undertaken, the Contractor shall obtain a certificate from a certified Maring Chemist and/or competent person showing that all spaces, compartments, tanks, voids, etc., including pipe lines, in, adjacent to, or upon which such work is to be performed, are gas free and safe for "hot" work. Subsequent gas and oxygen deficiency tests shall also be performed as necessary. See requirements as contained in Subparts B, C and D of reference (c).

18. GOOD HOUSEKEEPING. The ship's force and Contractor are obligated to comply with provisions as contained in Sections 1915.51 and 1915.66 and/or 1916.51 and 1916.66 of references (c) and (d), as applicable.

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J-M 83

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RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESIDENT SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN
LONG BEACH NAVAL SHIPYARD
LONG BEACH, CALIFORNIA 90801

Date:

From: Resident Supervisor of Shipbuilding, Conversion and Repair, USN, Long Beach
To: Personnel Requiring Access to Inactive Fleet Ships

Subj: Safety Precautions to be observed while aboard Inactive Fleet Ships

Ref: (a) LBNS Safety Supplements 0114 Series

1. The routine hazards normally associated with shipboard life are considerably compounded on Inactive Ships and Craft. Personnel entering these ships/craft are enjoined to remain safety conscious at all times and to wear all protective equipment as required in reference (a).

2. The "buddy system" has been incorporated for your own protection. No person shall gain access to an inactive or stricken ship unless he has a "buddy" with him. The two should remain together during their travels within the ship. They should depart the ship together.

3. Several of the unique hazardous conditions that may be encountered aboard an inactive ship/craft are listed below. The list is not meant to be all encompassing, but merely points out some of the more prevalent hazards known to exist in these ships/craft.

Low overhangs, and high hatch coamings
Oil, grease and other foreign material on the deck.
Access holes in the decks and bulkheads for the diffusion of DH air.
The possibility of exposed (energized) electrical cables.
Missing ladders or handrails around ladder wells.
Poor lighting (personnel should carry a flashlight).
Missing safety chains around trunks.
No smoking while touring an inactive ship/craft.

4. RESUPSHIPLBEACH personnel will sign a copy of this format and leave it with his Department Head prior to visiting any ship/craft in the Naval Inactive Ship Maintenance Facility.

A. W. DUACSEK

I have read and understand the above safety precautions.

Signed_____

Enclosure (1)
0653.1-9

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RESUPSHIPLBEACHINST 5100.27C
1 October 1973

RESUPSHIPLBEACH SAFETY SUPPLEMENT NO. 0653.2

Subj: Fixed Carbon Dioxide (CO_2) Systems

1. GENERAL. Fixed carbon dioxide (CO_2) systems on ships are always a potential danger in that activated systems inadvertently discharged would, in all probability, cause asphyxiation; and if they are inactivated, the ship loses fire fighting capabilities. To minimize the hazards involved, no RESUPSHIP employee shall be permitted to inspect and/or allow work in spaces provided with fixed CO_2 systems until the system has been rendered inoperative by the ship's force and gas free certificate furnished by the Contractor.

2. SCHEDULING DEACTIVATION AND ACTIVATION. The Planning Officer shall include in job order specifications the requirement that the inactivation of fixed CO_2 systems will be one of the first projects undertaken in the repair or overhaul and reactivation will be completed prior to sea trials.

3. WORK ON SYSTEMS. The Contractor, as authorized by specifications, will be responsible for the installation, testing, maintenance, activation and deactivation of fixed CO_2 fire fighting systems. Work will be accomplished in accordance with job order specifications only after obtaining signature from the ship's Commanding Officer.

a. Deactivation of System

(1) The system will be rendered inoperative by disconnecting the cylinders from the entire system (piping and control) and by then installing cap heads on all cylinders. If the cylinders are to be removed, extreme care must be used to prevent damage to heads or valves which would result in the escape of CO_2.

(2) Any space in which the CO_2 system has been deactivated will have a sign posted by the Contractor that reads:

"DANGER - CO_2 SYSTEM SECURED - STORE NO FLAMMABLES"

b. Activated System

(1) During the course of the overhaul it may become necessary to activate fixed CO_2 systems when flammables are to be stowed in a compartment. In such case, the RESUPSHIP Quality Assurance Representative will first notify the ship's Commanding Officer and then request the Contractor to activate the system. Once the system is in operation, the ship's Commanding Officer assumes responsibility for surveillance of that system and the compartments or spaces involved.

MT-PWHD-005683

(2) Private shipyard employees will not be permitted to work in such spaces until the RESUPSHIP Quality Assurance Representative has been advised of the circumstances so that he may take appropriate action to insure the safety of the employees involved.

4. DEPARTURE. The RESUPSHIP Quality Assurance Representative will insure that the ship's Commanding Officer is aware of the status of all fixed CO_2 systems prior to the departure of the ship from the yard.

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Mommy,

3/5/79

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4	Describes materials in the four boxes produced from garage
5	TLV library covers from 1961 to present
9	Produces documents re: industrial health programs in other Naval shipyards issued between 1967 and 1974
9	Collected documents to get idea of what the other shipyards were doing in terms of industrial health
11	No goal outline was ever created for LBNS industrial health program, as was at other shipyards
11	Didn't prepare an outline, incorporated ideas into the larger shipyard safety manual
12	3 or 4 pages of the shipyard safety manual deal with asbestos products
18	Asbestos dust samples were always analyzed by Navy laboratories
18	Had silica tested by ouside lab twice. Did not have adequate equipment to come up with percent free silica analysis of material
20	Condusted testers from Navy Environmental Health Center around shipyard and provided them with any material they asked for.
21	Trade names index consisted of products which were hazardous and might possibly show up at LPNS.
23	Corresponded with ROPERT MANNING 15 times between 11-28-73 and 2-6-74
24	Always believed that SMITH was superior/ was informed by informed by MANNING that he was his superior
24-25	R.MANNING was critical of all areas of LPNS industrial hygiene program
25	Had 8-10 conversations--R. MANNING did not indicate that S. MANNING would be fired.
33-36	Discussed entries in activity log
37	Attended meetings of shop 56 union on at least four occasions
38	First one was in the fall of 1967
41	Dr. ELLSTEADT perormed pulmonary function tests annually on pipe coverers and insulators prior to S. MANNINGs arrival at LPNS

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J-M 83

41 Main purpose of June 1970 meeting of shop 56 supervisors was to get Dr. ELLSTEADT to discuss pulmonary function test results

42 Webster Ay was very displeased because test results were not made available to employees

42 ELLSTEADT ended up making very general statement as to overall results

44 First reviewed HATHAWAY and DELUCA records 5-20-69 Found that the reader diagnosed Asbestosis right out

45 Their forman informed the two workers of their results S. MANNING informed their foreman of findings

46 Foreman told MANNING that he discussed the situation with the two men and tried to convince them to get out of the trade

46 Meeting with SELIKOFF sponsored by union in 1973

48 Included hazards associated with installation and ripout of asbestos insulation products, results of asbestos exposure, and dicussion of protective devices.

48 HOLADAY and S. MANNING both felt that throw away mask respirators were more acceptable because they were better accepted by workers

50 Indoctrinated all foreman on the asbestos problem in 1971

59 Did not use the time weighted average method, in orker for it to be valid, one must follow the worker for an 8 hour period--impossible with time schedule

62 Submitted asbestos report at AIHC conference 5-5-69

63 Report was eventually sent out in August of 1969

64 Wrote a report for NAVSHIPS, sent it to shipyard commander. Was informed 5-8-69 by Naval Ship Engineering Center that his letter had been "bucked down to them" and never went out.

64 Does not know if report ever went to NAVSHIPS

65 Exhibit C to depo is report referred to in 5-8-69 entry

67-68 Attended AIHA conference May 11-16. Changed portions asbestos report in light of conference.

72 Notes instance where requirements re: asbestos product handling existed but werent brought t MANNINGs attention

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SHM 7901.D

COPY

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

FILE COPY

WALTER C. RIGSBY,
JOSEPH K. KLOSE and
SHELDON H. MANNING,

Plaintiffs,

vs.

JOHNS-MANVILLE, etc., et al.,

Defendants.

No. C 151 947

VOLUME 5

CONTINUATION OF DEPOSITION OF SHELDON H. MANNING, a plaintiff, taken by defendant Johns-Manville at 9:35 a.m., Monday, March 5, 1979, at 111 North Hill Street, Los Angeles, California, before Lucia Moskal, CSR, a Notary Public.

Reported by:
Lucia Moskal, CSR 1222
Registered Professional Reporter

No. LA-770-79

RENDEL B. HUTCHINGS
Certified Court Reporters

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JM - 83

LOS ANGELES 90065 3436 N. Figueroa 223-1191
SANTA ANA 92701 523 N. Grand 547-6169
WEST LOS ANGELES 90049 654 N. Sepulveda 472-9578
CAPISTRANO BEACH 92624 34582 Via Verde 496-7121
SAN DIEGO 92101 326 Broadway 233-6227

MT-PWHD-005689

APPEARANCES OF COUNSEL:

For Plaintiff Manning:	ROSE, KLEIN & MARIAS BY ROBERT B. STEINBERG
For Johns-Manville Sales Corporation:	HAIGHT, DICKSON, BROWN & BONESTEEL BY APRIL HASKELL
For J. P. Stevens:	ANDERSON, McHALE & CONNOR BY JAMES M. TILLIPMAN
Also Present:	BOLTON, HEMER & DUNN BY KENNETH W. DRAKE
For Pittsburgh Corning Corporation:	BREIDENBACH, SWAINSTON, YOKAITIS & CRISPO BY JAMES S. VAN DAM
For Fibreboard Corp.:	CHASE, ROTCHFORD, DRUKKER & BOGUST BY HENRY E. KAPPLER
For Celotex Corp., successor to Philip Carey Corporation:	COYLE, MARRONE & ROBINSON BY RICHARD B. COYLE
For Amitex:	GILLILAND, ROBERSON & MOSER BY WILLIAM ROBERSON
For Combustion Engineering:	MARTIN & STAMP BY LLOYD V. STAMP
For Nicolet, Inc.:	McKAY, BYRNE & UDKOVICH BY JOHN P. McKAY
For Armstrong:	MORGAN, WENZEL & McNICHOLAS BY JOSEPH A. MAHONEY
For Crown Cork Seal:	MORRIS & POLICH BY KIM M. DUNNING
For Raybestos Manhattan:	NORBY & BRODEUR BY THOMAS E. SMURRO
For Keene Corporation:	PATTERSON, RITNER & LOCKWOOD BY THOMAS S. MULLIGAN

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JM - 83

MT-PWHD-005690

APPEARANCES OF COUNSEL (Continued):

For GAF:	PAUL, HASTINGS, JANOFSKY & WALKER BY MICHAEL SANDERS
For H. K. Porter, Inc.:	SCHELL & DELAMER BY KENNETH B. PRINDLE
For Unarco Industries, Inc.:	SHIELD & SMITH BY LAURA DIANE KOTSIRIS
For Owens-Corning Fiberglas Corp.:	WATERS, McCLUSKEY & CORCORAN BY JOSEPH BOGAN
For Flintkote:	VIRGIL R. WELLS BY STEVEN D. HAMOR
For Eagle-Picher Industries:	YUSIM, CASSIDY, STEIN & HANGER BY ROBERT LEVINE

E X H I B I T S

DEFENDANTS'		MARKED
JJ	-"Fundamentals of Industrial Hygiene" (Retained by Witness)	4
KK	- Handwritten lecture notes (3 pages) (Exhibits, Vol. IV, pp. 1 - 3)	5

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JM - 83

SHM

MT-PWHD-005691

APPEARANCES OF COUNSEL (Continued):

For GAF:	PAUL, HASTINGS, JANOFSKY & WALKER BY MICHAEL SANDERS
For H. K. Porter, Inc.:	SCHELL & DELAMER BY KENNETH B. PRINDLE
For Unarco Industries, Inc.:	SHIELD & SMITH BY LAURA DIANE KOTSIRIS
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For Flintkote:	VIRGIL R. WELLS BY STEVEN D. HAMOR
For Eagle-Picher Industries:	YUSIM, CASSIDY, STEIN & HANGER BY ROBERT LEVINE

E X H I B I T S

DEFENDANTS'		MARKED
LL	- Long Beach, California, brochure (Exhibits, Vol. V, pp. 1 - 3)	26

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SNTM

MT-PWHD 005602

MS. HASKELL: Mr. Manning, and Mr. Steinberg, at Friday's session of the deposition, it was requested that the contents of four boxes containing materials that had previously been in Mr. Manning's offices at the shipyard be gone through over the weekend, and those documents which had in fact been at the shipyard between the years of '67 and 1974 when Mr. Manning left be produced at this morning's session of the deposition. Can one or the other of you tell us what is being produced and what is not being produced this morning?

MR. STEINBERG: Well, this morning, the only thing that is being produced is a Navy handout concerning Long Beach, California, and the only thing of interest here, other than giving the mission and history of Long Beach Naval Shipyard and its background, is a schematic and layout of the shipyard itself, which Mr. Manning thought might be of interest to everyone. It is also, I assume, something he took with him from the shipyard, so, by definition, it falls into the category of the things you asked for the other day. That's the only thing we have here this morning.

I'm going to recite for the record those things which Mr. Manning spent a good deal of the weekend searching for, and has now collected some -- I guess all of the things, and I am going to read the things that, again by definition, fall in the category of items removed from the shipyard.

Give me a moment until I find my list.

MR. KAPPLER: In other words, you have examined these yourself?

PRODUCED
JM - 83

MT-PWHD-005693

MR. STEINBERG: I have not.

Firstly, there are materials, and I'm not sure exactly how voluminous they are, on industrial hygiene as it relates to other shipyards, including Norfolk Naval Station, Mare Island, and Bremerton.

There is a shipyard safety manual of some bulk.

There is a ventilation manual.

There are reports of tests for contaminants other than asbestos.

There is a library of sorts of TLV's, I assume similar to the one item that was previously produced here last week, covering --

Mr. Manning, do you know how many years that covers?

THE WITNESS: From 1961, with maybe some exceptions.

MR. STEINBERG: There is a schematic of the shipyard, which we have produced here.

There are various rosters, and I take it those are a listing of personnel at the shipyard during the years Mr. Manning was there.

There is a copy of a 1970 letter from Mr. Manning to his superior, regarding the industrial hygiene generally at Long Beach Naval Shipyard.

There are various analytical reports, and I'll leave that to Mr. Manning to describe exactly what they are.

There is a Fall 1972 report of an organization called the Environmental Health Group of Cincinnati, which concerns Long Beach Naval Shipyard, some study that they did there.

PRODUCED
JM - 83

MT-PWHD-005694

MS. HASKELL: What is the name of the organization?

MR. STEINBERG: Environmental Health Group.

THE WITNESS: Environmental Health Center, they call themselves. Naval Environmental Health Center.

MR. STEINBERG: There are some lists of hazardous materials, which is information that had been taken from the trade names index.

And there's also some correspondence between Mr. Sheldon Manning, the plaintiff, and Mr. Robert Manning, for the period of time after Mr. Robert Manning came to the shipyard until Mr. Sheldon Manning left.

Now, I have some concerns about these materials. Number one, I'm not sure how much of it is really relevant and material to this case or could lead to the discovery of admissible evidence in this case.

Secondly, to produce it all, particularly the shipyard safety manual, may become rather oppressive and burdensome for Mr. Manning, because of the bulk involved, and particularly because he is not the only source of that material. I have not looked at the materials as yet.

And thirdly, to produce these materials in the middle of examination of the witness, in the middle of the first volume of this 4-volume log, I think would unduly extend his deposition for at least another two weeks. So it is my suggestion that I'm going to preserve these materials in my possession until I've had a chance to review them, and once I have had a chance to review them, I'll make them available to the extent which I think is consistent with their

PRODUCED JM - 83

MT-PWHD-005695

materiality and their discoverability.

MS. HASKELL: Mr. Steinberg, I appreciate your position. I think that as we've noted earlier, it would be foolhardy for any of us to stand on an objection to the production of documents on the grounds that it might not be relevant to the discovery of admissible evidence in this particular action, since it would simply subject Mr. Manning to a deposition noticed in a different case or perhaps several different cases, since most of this material, at least on the face of it as it is described, certainly would be relevant to the discovery of admissible evidence in several of the lawsuits, if not directly Mr. Manning's lawsuit. Much of this information appears on the face of it, at least as it is described, to also be relevant to issues in this case, if not admissible evidence in this case.

I realize that we are yet a few days away from concluding Mr. Manning's deposition, just based on the documents that we now have before us. On the other hand, as I am sure you appreciate, it takes some period of time to prepare to examine a witness based on documents that he's produced, and I would not like to wait until we are done examining on these particular documents to have further documents produced. Even staying up till 3:00 o'clock in the morning and getting up at 6:00 o'clock in the morning to read documents, as I have done on several occasions, I don't think I'm going to be able to get through the documents that are described here in one day's time.

MR. KAPPLER: I join in that, and request that they be

PRODUCED
JM - 83

MT-PWHD-005696

produced, Bob.

MR. BOGAN: Furthermore, the documents that Mr. Steinberg has described were previously requested in the Notice to Produce, were they not?

MR. STEINBERG: Well, I'm not sure they were.

MR. McKAY: I would just only add, Mr. Steinberg, the fact that these documents may be available from another source is not a proper objection at this time. They are in the custody and control of your client and available for production during his deposition. I don't think there's any question but they're relevant and material, given his own complaints of injury and given the facts of expertise to which he has testified. And I am not as confident as you are that we may be able to get them from another source, and for that reason, would join with my distinguished colleagues and request that you produce them at noon.

MR. STEINBERG: You're not going to have them at noon. I can guarantee you that.

MR. McKAY: I'll back up. How about at 5:00 o'clock?

MR. STEINBERG: You will not have them at 5:00 o'clock.

MR. KAPPLER: I request that they be produced tomorrow morning.

MR. STEINBERG: Let's go off the record and discuss this.

MS. HASKELL: That's fine.

(A discussion is held off the record.)

MS. HASKELL: While we were off the record, we talked

PRODUCED
JM - 83

MT-PWHD-005697

about the practical problems involved in Mr. Steinberg's reviewing the documents that his client has, and there was a request made that we break this deposition for a day or so to give Mr. Steinberg an opportunity to do that. Mr. Manning is going to check with his wife and see when his dental appointment is scheduled, and we'll try and work around that, to give both Mr. Manning a chance to see the dentist and Mr. Steinberg a chance to review the documents so that we can have the documents before we conclude Mr. Manning's deposition, and so we can determine how long it will take to conclude Mr. Manning's deposition.

SHELDON H. MANNING,

a plaintiff herein, having been previously sworn, testified further as follows:

EXAMINATION

BY MS. HASKELL:

Q. In the meantime, let me ask you, Mr. Manning, what some of these documents are, if I may. Okay?

A. Yes.

Q. Is the mike on?

A. Yes.

Q. The first document that Mr. Steinberg mentioned that you have, other than this Naval Shipyard drawing that was produced, are materials on industrial hygiene relating to other shipyards. Is that right?

A. Yes.

PRODUCED IM - 83

MT-PWHD-005698

Q. Those other shipyards are which shipyards?

A. Norfolk Naval Shipyard, Mare Island Shipyard --

Q. M-a-r-e?

A. M-a-r-e.

Puget Sound Naval Shipyard and Bremerton. There may be something there from Crane, Indiana, Naval installation. It's an ammunition depot or something of this sort.

These documents are outlines or instructions relating to the industrial hygiene programs in these particular places.

Q. During what years or for what years?

A. They were issued sometime during the years that we're talking about. I don't know the exact dates on these documents, and some of them maybe don't have dates.

Q. When you say "the years we're talking about," you mean to refer to the years 1967 through 1974?

A. Yes.

Q. How did you come to receive copies of these documents?

A. I collected the documents from the Puget Sound Naval Shipyard, some of them, when I was there for indoctrination in 1967. Some of these documents, I wrote to them and asked them for them, and they sent them to me.

Q. Why did you write and ask for documents involving industrial hygiene at other shipyards other than the one you were working at?

A. These documents were merely to give me some idea of what was happening in other shipyards and help guide myself, and the objectives of the program. These

PRODUCED
JM - 83

MT-PWHD-005699

programs were larger than mine, so far as staffing, and had been there longer, more established. These were paper outlines of what they thought they should be doing and what they were doing in these various places.

Q. When you came to the Long Beach Naval Shipyard in -- was it February of 1967?

A. March.

Q. I'm sorry. When you came to the Long Beach Naval Shipyard in March of 1967, was there such a similar outline for the Long Beach Naval Shipyard available to you?

A. No.

Q. Did you inquire of anyone whether such an outline had ever existed?

A. Yes.

Q. Who did you inquire of?

A. Cliff Kreiger.

Q. And he told you no?

A. Yes.

Q. Did you inquire of anyone else other than Cliff Kreiger as to whether or not such an outline ever existed prior to your arriving at the Long Beach Naval Shipyard?

A. No.

Q. During the time you were at the Long Beach Naval Shipyard, did you ever prepare such an outline for your successor?

A. Not in any great detail. The way I handled that was to incorporate whatever I had to offer into the much larger shipyard safety manual.

PRODUCED
JM - 83

MT-PWHD-005700

Q. These outlines of the industrial hygiene programs at shipyards at Mare Island, Norfolk, Virginia, Puget Sound, and the Crane, Indiana, Naval installation comprise approximately how many pages apiece?

A. Approximately 30, 35 pages.

MR. KAPPLER: The one in which you incorporated your own material, is that one of the ones that you have in your possession in the garage, or downtown now?

THE WITNESS: I have the shipyard safety manual in its entirety at the time I left.

Q. BY MS. HASKELL: And a portion of that is this outline that you incorporated, outlining the industrial hygiene program at the Long Beach Naval Shipyard?

A. I think that's contained in it.

Q. The shipyard safety manual that Mr. Steinberg described when we were off the record, have you reviewed that document since Friday of last week?

A. I didn't go completely through it. I leafed through it and then saw that at least the material on the asbestos is intact.

Q. There is material in that safety manual relating to asbestos products; is that right?

A. That is correct.

Q. Approximately how many of the pages of the shipyard safety manual deal with asbestos products?

A. About three or four pages. This material is already in your hands.

Q. This was one of the documents that you produced

PRODUCED
JM - 83

MT-PWHD-005701

several days ago?

A. Yes.

Q. Approximately how many pages is the entire shipyard safety manual?

A. I didn't count the pages. It's about an inch and a half to 2 inches thick. Maybe more.

Q. The ventilation manual which Mr. Steinberg mentioned when we were off the record, is that the ventilation manual that you described on Friday as a document that you brought with you to the shipyard?

A. Yes.

Q. That is the same document from which you removed certain pages, copied them, and enclosed them in correspondence that you wrote to other people?

A. Yes.

Q. Mr. Steinberg also mentioned when we were off the record that you have reports for contaminants at the shipyard other than asbestos.

A. Yes.

Q. Who prepared those reports?

A. I did.

Q. Approximately how many such reports are there?

A. Somewhere between 20 and 30.

Q. What is the approximate length of each report?

A. Generally one, two, three pages.

Q. Each of these reports deals with a different contaminant?

A. There are several reports about the same thing.

PRODUCED

MT-PWHD-005702

It's virtually everything I wrote, as far as reports on contamination in the shipyard, with the exception of noise measurements and documents relating to the hearing conservation program.

Q. I believe Mr. Steinberg mentioned that these reports did not contain information on asbestos. Is that right?

A. I think all the material on asbestos has been presented before.

Q. Did you keep all of these reports in one file folder?

A. They are now in one file folder. I had to do a lot of sorting. I have noticed that I have many copies of the same report sometimes.

Q. You didn't have all of these reports in one place several days ago when you started going through these documents?

A. They were in several places, several different folders.

Q. Did any of those several folders contain similar reports for asbestos?

A. All that is left now are copies of reports that have been presented.

Q. These reports for contaminants, do they contain the results of tests that you personally conducted?

A. In most part.

Q. What else do they contain, other than reports of test results that you personally conducted?

PRODUCED JM - 83

MT-PWHD-005703

A. Well, it would be descriptive material, describing the situation. And also, in many cases, there would be recommendations made if it was found that these were necessary.

Q. The library of TLV's that you have that Mr. Steinberg described when we were off the record, are these similar to the TLV listing that was produced on Tuesday or Wednesday of last week?

A. Yes.

Q. Are there several of these listings?

A. Yes.

Q. Approximately how many?

A. Ten.

Q. These are for a number of years?

A. Yes, and from, I think, several sources.

Q. What years do these TLV lists span?

A. Well, at least 1961 to 1974, maybe some later. I don't know.

Q. Mr. Steinberg described certain rosters that you have in your possession. Approximately how many such rosters do you presently have?

A. I think probably there were a half a dozen, six.

Q. Are these rosters, each of them, for a different year?

A. No.

Q. For what years do you have such rosters?

A. Well, they're taken from the years that we're

PRODUCED
JM - 83

MT-PWHD-005704

talking about, '67 to '74, roster of the shipyard personnel in the dispensary, rosters of the Naval Industrial Hygiene Association, several other rosters that may be pertinent and may not.

Q. These are not all rosters of shipyard personnel?

A. No.

Q. Some of them are rosters of professional associations to which you belong?

A. That is correct.

Q. Are there rosters of any other groups other than shipyard personnel or specific units of shipyard personnel or professional organizations to which you belong?

A. No.

Q. So that's all the categories of people described in these rosters; is that right?

A. That is correct.

Q. Mr. Steinberg described a 1970 letter from yourself to your superior. Who was the letter directed to?

A. Dr. Jose C. Smith.

Q. That letter generally described the industrial hygiene conditions at the shipyard at or about the time that you wrote the letter?

A. Yes.

Q. Approximately how many pages does that letter consist of?

A. Fifteen pages.

Q. Is there mention made in that letter of the conditions at the shipyard with respect to the use or ripout

PRODUCED

MT-PWHD-005705

of asbestos products?

A. I don't think that was specifically mentioned. It may have or may not. I think not.

Q. Is there mention made in that 1970 letter from yourself to Dr. Smith with respect to your ability to do dust count testing and the equipment that you had available?

A. I think there probably was some mention of the shortcomings and inadequacies of the amount of equipment I had.

Q. As well as the inadequacies of your staff?

A. That is correct.

Q. Mr. Steinberg also mentioned a category of documents which he described as various analytical reports while we were off the record. Do you know what he was referring to?

A. Yes. There may be a few -- actually, in the first category, there may have been some reports by -- analysis of shipyard air used by sandblasters, supplied air, and there was some reports that I had to make for diving air. The divers used my services to find out about the purity of the air canisters.

That is, I think, the extent of it. There were, oh, some reports on analysis of settled dust, sandblasting material, and this sort of thing, and reports for free silica that I had sent out and had analyzed at various places.

Q. You had lab analyses of dust samples done outside of the shipyard?

PRODUCED
JM - 83

MT-PWHD-005706

A. Yes.

Q. By independent laboratories, or by Navy laboratories?

A. By Navy laboratories, and -- yes, one outside laboratory.

Q. Mr. Manning, did you ever on any occasions have asbestos dust samples analyzed by an outside laboratory?

A. No.

Q. On how many occasions did you have silica dust analyzed by an outside laboratory?

A. Outside the shipyard?

Q. Yes.

A. Long Beach Naval Shipyard?

Q. Yes.

A. Twice, I think.

Q. Once by a naval lab, and once by an independent lab?

A. That is correct.

Q. On the occasions that you had silica dust analyzed by a laboratory off the base or outside of the shipyard, what was the reason for having it done?

A. In order to understand the toxicity and supply the needed material to come up with the particular TLV for silica-containing dust, I had to have a percent free silica analysis of the material.

Q. You didn't have the equipment to do that yourself?

A. No, I did not.

Q. Did you have the professional capability to do

PRODUCED
JM - 83

MT-PWHD-005707

that if you had had the necessary equipment at your disposal?

A. Yes.

Q. Approximately how many of these analytical reports do you have in your custody?

A. Oh, about five, six or seven.

I might add that I have about three analytical reports of silica dust performed on material in the shipyard that I did not send out. It might have been two. There was one done in Maryland, such as part of their study on abrasives, and there was one sent out by a Mr. Sheehan, who was an industrial hygienist back in the early fifties at the shipyard, that I was able to obtain.

Q. Do those two reports fit into the number of five or seven that you gave me, or are they in addition to the five or seven reports that you mentioned?

A. These are all -- about five to seven, everything.

Q. Including those two?

A. That's right.

Q. What was Mr. Sheehan's first name?

A. I do not know. It may be on some of the material.

Q. Was he Mr. Marr's predecessor, to your knowledge?

A. That is correct.

Q. His name is spelled S-h-e-e-h-a-n?

A. I think so.

Q. These various analytical reports that you have of shipyard air and shipyard dust, approximately how many pages do each of these reports comprise?

PRODUCED
SM - 83

MT-PWHD-005708

A. Oh, 10 or 12.

Q. I believe Mr. Steinberg, when we were off the record, mentioned that you have a copy of a Fall of 1972 report of the Navy Environmental Health Center of Cincinnati's study at the Long Beach Naval Shipyard. Is that right?

A. Yes.

Q. Did you participate in any way in the study that was done by the Navy Environmental Health Center?

A. I helped conduct them around the shipyard and point out the things that they wanted to see.

Q. Did you provide them with any data or statistics?

A. They had access to all the material that they asked for.

Q. Did you personally provide them with any data or statistics?

A. I may have. I assume I probably did.

Q. Approximately how many pages does this study by the Navy Environmental Health Center of Cincinnati comprise?

A. It is not the complete study, but it is a study relating to the industrial hygiene program.

I also, for some reason, have a study for the -- I guess the ophthalmologic program. Optometrists. And I probably have somewhere, or did have the rest of it, but I can't find it.

Q. The portions that you have, how many pages do they consist of?

A. About 25 pages.

Q. Mr. Steinberg mentioned when we were off the

PRODUCED
JM - 83

MT-PWHD-005709

record that you have lists of hazardous materials which came from the trade names index card file. Is that right?

A. I have several documents and lists. One list I have came from the Puget Sound Naval Shipyard, and it was their list of toxic materials. I acquired that in 1967 when I was there.

I have the ACGIH trade names index, and there may be some other material of this sort that I -- I don't know right at the moment. We'll have to search it out. There may be some material on this particular subject.

Q. Is there a list of hazardous materials that were used at the Long Beach Naval Shipyard?

A. No, except in my possession, as I stated before, I started to make up a trade names card file for my own use and reference.

Q. Did that trade names index file contain only the names of products used at the Long Beach Naval Shipyard?

A. Not necessarily, no.

Q. Was there some way that you distinguished on your list products that were used at the Long Beach Naval Shipyard, as distinguished from products that were simply included because you had an academic interest in them?

A. It wasn't an academic interest. These things are kept in the possibility they may appear in the shipyard. Formulations change. Certainly in the asbestos area where the formulations change over the years, I may not

PRODUCED IM - 83

MT-PWHD-005710

have known it or known it at the time, but I'd like to keep track of these things.

I would put any information in that trade names index, whether I thought it was in the shipyard or not in the shipyard, on the possibility that it may at some later date -- that I may at some later date encounter it. The chances are, if it's in one shipyard, it possibly could appear in another one.

Q. Did you distinguish at all in that trade name index file between products that you knew to be in the shipyard and products that you didn't know to be in the shipyard or that you anticipated to come in the shipyard later?

A. I did not.

Q. Approximately how many of these lists of hazardous materials do you have?

A. Well, there's at least two that I know of. There may be more. I have a list that was put out by NIOSH that's available to anyone at a price. Anybody who writes -- it's available to the public, and it's about as thick as a large telephone book.

Q. What year did you obtain that list?

A. About 1973 or '4. I think it was published in '72 for the first time.

Q. Approximately how many pages is the Puget Sound list of hazardous materials?

A. Oh, 50 pages.

Q. And the ACGIH list?

PRODUCED
JM - 83

MT-PWHD-005711

A. Oh, a hundred pages.

Q. When we were off the record, Mr. Steinberg also indicated that you had certain correspondence between yourself and Mr. Robert Manning; is that correct?

A. That is correct.

Q. Is there more than one letter back and forth between yourself and Mr. Robert Manning?

A. Yes.

Q. What period of time does this correspondence cover?

A. It covers a period of time between November 28, 1973, and February 6, 1974.

Q. What generally is the subject matter of this correspondence?

A. His correspondence to me concerned his desires and wishes as far as the industrial hygiene program was concerned, and outlined what he expected of me.

My correspondence was in reply to some of this, and some of my correspondence back was in compliance with his requests, and some other correspondence later as to more things that he wanted done and some of his review of my work and some of his review of particular reports, and et cetera, and et cetera.

Q. During the period between November 28th, 1973, and February the 6th, 1974, approximately how many letters were exchanged between yourself and Mr. Robert Manning?

A. Oh, 15.

PRODUCED
JM - 83

MT-PWHD-005712

Q. These letters were approximately how many pages in length?

A. Five -- three to five, six pages.

Q. What was Mr. Robert Manning's position during the period between November the 28th, 1973, and February 6th, 1974?

A. He was head of the Industrial Hygiene branch of the Navy Regional Medical Center.

Q. At that time, he was your superior?

A. That is correct.

Q. He was the person who was your immediate supervisor?

A. I had no official notice of this. But, however, in his first correspondence to me, he indicated that he was my superior.

Q. That was how you came to learn that your chain of command or your line of command had been shifted from the dispensary to the Regional Medical Center?

A. I had always believed that the chain of command came from me to Dr. Smith, but by letter of November 28th, he informed me that he was my superior.

Q. Did you confirm in some other manner that that was indeed the case?

A. I went along with it without making any objection.

Q. In this correspondence of November 28th, 1973, through February 6, 1974, did Robert Manning express any dissatisfaction with the manner in which you had done your job up to and including November 28, 1973?

PRODUCED JM - 83

MT-PWHD-005713

A. Yes, he did.

Q. In particular, what areas was he critical of?

A. All areas, I would say. I'm sure that this material will be available and you will be able to read it yourself, and what is in there is self-evident.

Q. Did you and Mr. Robert Manning have any conversations between the period of November 28, 1973, through February 25, 1974, when you left the shipyard, either person-to-person or face-to-face, or by telephone?

A. Yes.

Q. On how many occasions?

A. Oh, eight or ten occasions.

Q. Were these by telephone or face-to-face?

A. Both.

Q. Did Mr. Robert Manning during any of those conversations indicate to you that you were going to be terminated from your position at the shipyard?

A. No.

Q. Did Mr. Robert Manning indicate to you during any of those telephone conversations that you might be terminated from your position at the shipyard if certain things did not improve?

A. No.

Q. Mr. Manning, would this be a good time for you to take a break to call your wife to determine whether or not you have a scheduled dental appointment?

A. Yes.

MS. HASKELL: Let's do that for about 15 minutes.

PRODUCED
- 83

MT-PWHD-005714

(Recess taken from 10:20 a.m. to 10:50 a.m.)

(Whereupon the document previously referred to is marked by the reporter as Defendants' Exhibit LL for identification.)

MR. STEINBERG: Mr. Manning has an appointment with his dentist at 1:30 tomorrow afternoon. We have been discussing the last couple of days, actually, you know, how far he can go on the schedule that we've been maintaining. He was kind of pushing himself last week on the theory that, you know, let's just get it over with. But the end isn't in sight, and he has some doubts about his ability to continue on this schedule, and I do, too.

Our suggestion is that if we're going to go on indefinitely on a daily basis, that we try to limit it to half-days, and I think he might be able to kind of weather it through under those circumstances. Otherwise, I think his blood pressure is way up, and he's been a little nervous, and, you know, it's been a little bit of a grind.

I have a problem myself the next couple of days, tomorrow and Wednesday. I have to be in Sacramento, but I can have somebody else sit in. Half-days would help us.

Now, it is my suggestion, if you want to go to noon today, we can do that. We can break to review the records this afternoon. We can come back tomorrow morning and break for his dental appointment tomorrow afternoon. And then maybe look forward to maybe half-days Wednesday, Thursday and Friday.

MS. HASKELL: Let me make an alternative suggestion,

PRODUCED JM - 83

MT-PWHD-005715

Mr. Manning, and you can obviously address yourself to this better than the rest of us can.

Q. Why don't we go till noon today. Break. That will give Mr. Steinberg an opportunity to review the documents which can be produced tomorrow. I'd like to then give Mr. Manning tomorrow off and the next day off, and we'll take Mr. Hernandez' deposition. Do you think, Mr. Manning, that if you had two days off, you'd be able to proceed on a daily basis for a couple days after that? I don't want to push you.

A. I'm not objecting to the daily basis. I've been spending about 7 hours, 6 or 7 hours in here, an hour to an hour and a half going and coming, and I have -- I'm not as young as I used to be, and I have certain physical disabilities, and I feel that if I keep on the pace of daily, that length of time, why, that's going to interfere with my health, which I think it already has. But in the interests of trying to get these proceedings to some kind of end, why, I've pushed myself more than I ordinarily would by far, and I find that my pulse is way up and I've had headaches certain days here, naturally, and my wife says I look like hell. And for these reasons, I'd like to restrict it to half a day. I don't want to come in here and do a whole day.

MR. McKAY: For the purpose of the record, Mr. Manning, you have understood every question you have been asked, and there is nothing about your physical health that has interfered with your ability to answer, is there?

PRODUCED
JM - 83

MT-PWHD-005716

THE WITNESS: I hope that I've been able to answer correctly. But, as I say, I have physical disabilities, and from what has happened, I feel that there is some stress here and that I shouldn't be subjected to this stress. Now, if you feel that you're not satisfied with this, I'm sure that if I consult my physician and go down and talk to him and he takes a few measurements, that we can straighten this out.

MR. McKAY: Mr. Manning, that is not the problem. I'm asking about the prior testimony you've given. Have you been able to understand the questions you have been asked?

THE WITNESS: Yes.

MR. McKAY: When you have answered those questions, you have answered those questions that have been presented with a full and complete understanding of their nature?

THE WITNESS: Yes.

MR. McKAY: There is nothing about your physical condition that interfered with your ability to hear or understand the questions?

THE WITNESS: No.

MS. HASKELL: Let's go off the record for just a moment.

(A discussion is held off the record.)

MS. HASKELL: Here's the deal: We propose as defendants' Plan C, which we hope the plaintiff will adopt and go along with us on, that we adjourn today at 1:00 o'clock, that you review the documents, produce them tomorrow morning.

PRODUCED
JM - 83

MT-PWHD-005717

We will continue with Mr. Manning's deposition on half-day bases throughout the rest of this week from 9:00 until 1:00. Obviously, we will have to adjust that somewhat, since he has a dentist appointment at 1:30 and I presume he's got some travel time.

Q. Is that something you feel you could be comfortable with?

A. Yes.

MS. HASKELL: We have the matter of these depositions being noticed to continue from day to day including Saturday. If we're going to go half-days, if Mr. Manning does not feel that his physical condition would be affected, I would like to go on Saturdays, because we obviously are going to be cutting into deposition time drastically by going half-days.

MR. STAMP: Where would we hold it?

MS. HASKELL: We can have them at Shield & Smith's office, apparently.

MR. KAPPLER: That's all right.

MS. HASKELL: Hearing no objections, I assume that is acceptable.

MR. STEINBERG: I'm just about to raise an objection. I don't know what my schedule is.

MS. HASKELL: Would you look and advise us tomorrow? I don't want to put a lot of pressure on you, Bob, and I realize these cases are going to take a tremendous amount of your time, but realistically, if we're going to go half-days with the witness, we are cutting into available

PRODUCED
JM - 83

MT-PWHD-005718

deposition time tremendously, since we can't schedule other depositions in that dead time, and we have a lot of people's depositions to take.

MR. STEINBERG: It is not that you can't schedule the depositions. Your preference is not to.

MR. KAPPLER: Bob, if we run over, then you are going to have a real mess, you see.

MR. STEINBERG: You mean, if they overlap?

MR. KAPPLER: Sure.

MR. STEINBERG: I don't want to agree to it now. Let's see where we are on Friday, and let me check with the schedule. I hate to get into this habit, because, you know, I customarily work Saturdays, but that's just to catch up on the rest of the week, and I don't want to work Sundays to catch up because I didn't work Saturdays. I'm sure there are others in that boat around here, too.

MS. HASKELL: Why don't you check your schedule and let us know tomorrow, rather than awaiting until Friday. I can guarantee you we are not going to be done with Mr. Manning's deposition, taking it on half-days, by Friday. All right?

MR. STAMP: Is 9:00 o'clock okay?

MR. STEINBERG: 9:00 o'clock tomorrow? Yes, that's fine.

MR. LEVINE: April, are all other depositions which have previously been noticed now canceled?

MS. HASKELL: Yes.

MS. KOTSIRIS: Could you restate now what the

PRODUCED
JM - 83

MT-PWHD-005719

schedule is?

MS. HASKELL: The schedule is that we will run Mr. Manning's deposition until it is completed from 9:00 o'clock in the morning until 1:00 o'clock in the afternoon every day until it is completed, except Sundays; and when we complete Mr. Manning's deposition, other depositions will be noticed, which will be noticed with the times that they were previously noticed for, 9:30 to 4:30.

MR. BOGAN: Are we going until 1:00 today, April?

MS. HASKELL: Yes.

Q. Is that all right with you, Mr. Manning?

A. Yes. I feel that I'd be willing to go till Friday to see how I feel. If there is any adverse effects, if I feel my limitations are exceeded, why, I'll let you know.

Q. Do you feel at this point in the day that you're able to go forward now until 1:00 o'clock?

A. Yes.

Q. You will be able to understand my questions and respond to them properly?

A. Yes, yes.

MS. HASKELL: Let's go off the record for just a minute.

(A discussion is held off the record.)

MS. HASKELL: The document which was produced by Mr. Manning this morning has been marked by the court reporter as Defendants' LL for identification. I'm going to be giving

PRODUCED JM - 83

MT-PWHD-005720

it to the copying service to make one copy and bring it right back so we have the original, and then additional copies will be made and available for all defendants and plaintiff's counsel before the end of this session.

Q. Mr. Manning, I'm going to be asking you some questions about the journals which were produced last week. Do you have those in front of you?

A. Yes.

MR. STEINBERG: Off the record a moment.

(A discussion is held off the record.)

Q. BY MS. HASKELL: Mr. Manning, would you look at Page 83 of the paginated document.

Have you got that in front of you?

A. Yes.

Q. Do you see the entry for March the 19th?

A. Yes.

Q. Would you read that entry as it appears into the record, exactly as it appears.

A. March 19. "Went to USS DE HAVEN aft fireroom. Six laggers doing wet work - white coat and cloth application. Went to USS MANATEE. Took three dust samples. Six minutes of ripout. One man wore respirator. Other man complained that Safety Issue will only give out one filter at a time. Counted dust in afternoon. Had call from Harold White, Code 386, about foundry report. Sent it to him."

Q. You underlined certain portions of that entry in red ink, did you not?

PRODUCED JM - 83

MT-PWHD-005721

A. Yes.

Q. Which portions did you underline?

A. "Went to USS MANATEE. Took three dust samples."

Q. You then drew an arrow in red ink to that underlining, and above that arrow wrote the words "Asbestos Dust" in red ink. Is that correct?

A. That is correct.

Q. That is because you believe you were exposed to asbestos dust when you were aboard the USS MANATEE; is that correct?

A. That is correct.

MR. KAPPLER: When did you do that?

THE WITNESS: When did I mark this? Sometime after February 25, 1974. Maybe around April of that year.

Q. BY MS. HASKELL: You marked all the places where you thought you had been exposed to various chemicals or dust. Correct?

A. Yes.

Q. You did not mark the entry with respect to the USS DE HAVEN. Correct?

A. No.

Q. On the USS DE HAVEN, when you went to the aft fireroom, there were six laggers doing wet work; is that right?

A. Yes.

Q. What specifically is wet work? What were they doing?

A. Well, as it states here, they were putting on a

PRODUCED
JM - 83

MT-PWHD-005722

coat of -- called white coat, apparently something like plaster, probably over preformed material, and then on top of the white coat, they put on asbestos cloth, which is one of the ways they fabricated their insulation.

Q. That was not an application that you considered to expose you to asbestos dust, based on the fact that you didn't note it in your journal at a later date. Correct?

A. Well, it was entered as one asbestos dust. I apparently, from the looks of it, underlined at the wrong place. Actually, the exposure was at the ripout and where I collected the samples.

Q. And not at the point where they were applying this white coat-and-cloth application?

A. That is correct. The USS DE HAVEN is where they were doing the white work, and I didn't underline that. Where they were doing the ripout was aboard the USS MANATEE, and this was underlined. This is all correct. The exposure to asbestos was at the MANATEE, and not at the DE HAVEN, where it was all wet work.

Q. Would you look at the entry on that page for March the 21st.

A. I have it.

Q. Would you read that entry exactly as it appears into the record, please.

A. "Went to USS BENNINGTON auxiliary engine room. Two laggers not working. Got compressed air sample from Dry Dock 2 and 3. Called 56 Planning and found that Foreman Hutto had USS CANBERRA. Went to USS CANBERRA Number 3

PRODUCED
JM - 83

MT-PWHD-005723

fireroom. Took three ripout dust samples. Ran two compressed air samples and counted three dust samples." It was three ripouts, yes. Okay.

Q. You underlined the reference to the three ripout dust samples indicating "Asbestos Dust," all of that in red ink, at a later date. Correct?

A. That's right.

Q. What particular type of product was being ripped out on that occasion? Do you recall?

A. No, I don't.

Q. Would you read the entry for March the 24th?

A. "Talked to C. Kreiger about group coming in. Took three dust samples aboard USS CANBERRA, Number 2 fireroom. Counted them."

Q. What group was coming in that you talked to Mr. Kreiger about?

A. Well, offhand, I don't know. I'd have to check further to see who finally come in. They came and went. I have no recollection of who just did come in.

Q. Do you recall what product you took the dust samples from on board the USS CANBERRA?

A. No.

Q. Would you look at the next page, please. I believe it's paginated 84.

A. Yes.

Q. Do you see the entry for March the 25th?

A. Yes.

Q. Would you read that entry in its entirety into the

PRODUCED JM - 83

MT-PWHD-005724

record exactly as it appears.

A. "Took four dust samples aboard USS CANBERRA Number 1 fireroom. Talked to Safety about arrangements for meeting visiting group. Was called to Industrial Relations office to meet group at 1400."

Here we are. "Two men were from the union, three from Selikoff's group." Apparently I didn't get their names.

Q. What does the entry right adjacent to the word "group" say?

A. What was this? "Office to meet group at 1400. Two men were from union, three from Selikoff's group."

I don't know what that says. "Will get" something.

Q. Does it say "times"?

A. "Times," I guess, yeah.

Q. What union were these two men from?

A. I would think that they would be the pipe coverers and insulators and refrigeration workers.

Q. This would be from the local or from the national?

A. I would think the national. I'm hazy on this, and I can't be too specific, and apparently I didn't put down their names.

Q. Were the three people from Dr. Selikoff's group medical doctors, or were they other people as well?

A. Well, I think I remember, it was a Dr. Nickerson, and Duncan Holaday, and there was a doctor which I can't recall his name.

Q. How long were these five people at the shipyard,

PRODUCED JM - 83

MT-PWHD-005725

for how many days?

A. Oh, I can recall one day.

Q. This was in March of 1969. Correct?

A. That is correct, I think. Yes.

Q. Other than yourself, who else conducted these gentlemen on a tour of the shipyard?

A. I'm sure Webster Ay was there. I don't know who else was there. I think Cliff Kreiger was there. Possibly some pipe-covering foremen.

Q. Mr. Manning, during the time that you were the industrial hygienist at the Long Beach Naval Shipyard, did you attend any meetings of union people from Shop 56?

A. Yes.

Q. On how many occasions?

A. Well, either union-sponsored -- at least four that I can remember.

Q. These were meetings that took place at Shop 56?

A. No. I'm referring to, meetings generally that I attended were outside the shipyard, and sponsored -- maybe consisted in the first case, a meeting we covered, where Cooper and Tabershaw were there, and this was held at the Century Plaza Hotel, and it took up the whole day.

The second meeting that I can recall was a luncheon meeting held at Pierpoint Landing. The people attending there were Dr. Ellsteadt, who had performed the pulmonary function tests, Webb Ay and myself, and all the supervision --

Q. From Shop 56?

PRODUCED
JM - 83

MT-PWHD-005726

A. -- from Shop 56. Cliff Kreiger. John Nagle, the administrative officer of the dispensary, was there. There may have been others. There were, I think, about 15 people in attendance.

Q. What was the date of that meeting, approximately?

A. I'm only guessing, but I would believe it was in 1970, June. I probably have a note in my log.

Q. And the third meeting that you recall?

A. There was a meeting in Anaheim where the pipe coverers and insulators, I think, were having their national convention. It was held in one of the large hotels there, which I can't recall. One of the real large hotels. And Cooper and Tabershaw and -- no. Cooper and Balzer were there. Tabershaw, I don't think was there. He may have been. But these two doctors had been hired by the union to do some work. They had made a display, some display material about the dangers of asbestos, which consisted of a lighted sort of display that they had put together and fabricated. I think the use -- it was to be used in various presentations around the country to inform these people about the dangers involved.

Q. When did that meeting take place?

A. Again, I'd have to check my notes, but I would say that was somewhere about 1972.

MR. KAPPLER: How about the first meeting at the Century Plaza? When was that?

THE WITNESS: That was, I believe, in the fall of 1967.

MR. KAPPLER: Thank you.

PRODUCED
JM - 83

MT-PWHD-005727

Q. BY MS. HASKELL: This meeting that took place in Anaheim, the National Convention of Pipe Coverers and Insulation Workers, was that attended by the men from Shop 56?

A. Yes.

Q. Did you attend that meeting yourself?

A. The only thing that I attended was the part related to asbestos, and this was held in a side room where Tabershaw -- I mean Cooper -- I'm not sure Tabershaw was there. My memory is a little vague on it. But I know Balzer was there. And these displays were discussed, and there was some discussion about the asbestos problem, and things in general, and it lasted -- I think we went down sometime in the morning, and the session actually took place in the afternoon, two or three hours. Two hours, maybe, three hours, and then we came back.

Q. Who did you go with? Who is the "we" you're referring to?

A. I think I went with Cliff Kreiger. We went down together. I picked him up at his house, and we went down.

Q. When you were attending the portion of this meeting that dealt with asbestos, did you see any of the people from Shop 56 at the Long Beach Naval Shipyard at that display?

A. Oh, yes.

Q. More than 10 or 15 of these people?

A. Webb Ay was there. The supervision, I think, was

PRODUCED - 83

MT-PWHD-005728

there. Charlie Ay was in attendance, and some of the workers.

MR. KAPPLER: Do you have any photographs of the exhibits, by any chance?

THE WITNESS: No.

Q. BY MS. HASKELL: These exhibits, did they contain actual products?

A. They were pictures or various lighting operations -- I think it was lighted and done in glass, like this. It was a rather elaborate kind of thing that you see at expositions to explain things. It was an expensive and elaborate display.

Q. Was it pictures of actual installation of manufactured products?

A. Yes.

Q. Were there pictures of ripout of products from ships?

A. Yes.

Q. Were there pictures of any containers, cartons or bags of various manufactured products?

A. I couldn't say, but I think not.

Q. Were there pictures of microscopic fibers?

A. I think this was included.

Q. Was there a description at this particular --

MR. KAPPLER: You mean by that, enlargements?

THE WITNESS: Yes.

MS. HASKELL: Thank you.

Q. Was there a discussion at this meeting that

PRODUCED
JM - 83

MT-PWHD-005729

you attended on the subject of asbestos with respect to the various types of asbestos minerals that exist?

A. No, I think not. It didn't go into that much detail.

Q. This luncheon that you went to in approximately June of 1970 at the Pierpoint Landing with Dr. Ellsteadt, Webb Ay, all the supervisors from Shop 56, Mr. Kreiger and Mr. Nagle, consisting of approximately 15 people, what was the subject matter of that meeting?

A. I think mostly the purpose was to get Dr. Ellsteadt in a group. He was invited down there to discuss the pulmonary function tests and the results, if any, that he was to divulge.

Q. Prior to that meeting, had Dr. Ellsteadt already begun giving pulmonary function tests to some portion of the workers at the shipyard?

A. Dr. Ellsteadt had performed pulmonary function tests annually on the pipe coverers and insulators some time prior to my arrival, on an annual basis.

Q. And it was his reports of pulmonary function tests that you indicated to us on Friday that you had reviewed and logged in?

A. That's correct.

Q. Was there any doctor from the Long Beach dispensary present at this meeting with Dr. Ellsteadt?

A. I don't know. It is possible that Dr. Owenby may have been there. He may not. I think it occurred during a period that Dr. Owenby was acting as Medical Director. I

PRODUCED
JM - 83

MT-PWHD-005730

can't remember. Watkins wasn't there, and Smith wasn't there, I don't believe. So it is possible that Dr. Owenby was there.

Q. But you don't recall his being there?

A. I don't really recall.

Q. Was there some desire on the part of someone during that meeting to have Dr. Ellsteadt's pulmonary function tests made available to some group?

A. Well, I don't know whether this was discussed then. Webb Ay, in particular, over a number of years expressed his displeasure to me and other people about the results of these tests not being made available to the employees, that they were told nothing, and the fact is, this was a continuing thing. And it seemed to be that nobody that tried to get these things out could get anywhere with this. This was one, as I recall, of the subjects that was brought up. One of his great vexations. And I fully appreciate his feeling.

Q. So one of the purposes of this meeting was to discuss some manner by which employees could be advised of the results of their pulmonary function tests?

A. No. This didn't happen there. What actually happened was, all Dr. Ellsteadt contributed was that from his observations, he made the general statement that all these people were doing quite well, from his tests, that they were moving around like monkeys, and at least the pulmonary function tests showed that they were operating fairly well, although he did, I think -- to my recollection, there were some

PRODUCED JM - 83

MT-PWHD-005731

exceptions there that were noted early, and I think the testimony -- a man by the name of Hathaway in particular, I think, showed pulmonary function disability, along with X-ray findings that were rather -- that were enormous indications of exposure. And that man retired out of the yard.

Q. Mr. Manning, while we're speaking about Mr. Hathaway, and I believe Mr. DeLuca is the other man to whom you're making reference, would you look at Page 90, please, the entry of May the 20th. This is May the 20th of 1969, is it not?

A. 90?

Q. Page 90, sir, yes. The entry of May the 20th. Do you see that?

A. Yes, I see it.

Q. This is May the 20th of 1969?

A. Yes.

Q. Would you read that entry, please?

A. "Talked to Kreiger about report. He suggested putting in recommendation for cast-cutter trial. Will do. Went to files and looked up some records of pipe coverers and insulation workers." I mention Hathaway and DeLuca.

Q. Stop right there. You mentioned earlier in your testimony, I believe on Friday, that you had reviewed records of Hathaway and DeLuca.

A. Yes.

Q. Isn't it true that this entry of May the 20th, 1969, is the first record of your first review of those

PRODUCED
JM - 83

MT-PWHD-005732

records?

A. I would say that's correct.

Q. So you really reviewed Mr. Hathaway's records not prior to May the 20th of 1969. Correct?

A. I'm not certain that I didn't get into the files before -- I may not have indicated it. I was alerted about some of the findings rather early, I think, in my tenure there by Terry Miller, who was the X-ray technician, and he expressed some concern about the findings, and was concerned about these individuals, and was also concerned that they were not being notified.

Q. Mr. Manning, did you review Mr. Hathaway's or Mr. DeLuca's records on more than one occasion?

A. I'm certain that I did.

Q. You have a distinct recollection of that?

A. Yes.

Q. On this occasion of May the 20th, 1969, what was the purpose in your reviewing Mr. Hathaway's and Mr. DeLuca's records as opposed to just general review of the files?

A. What this appears to be -- the way I recall it, the records come back from the X-ray reader, whoever the doctor who read the X-rays, and these were reports. And Mr. Miller would save these reports for me, and I would go over them one by one, and what I'd seen here is that at that time the doctor who read the X-rays come right out and said these two men had asbestosis.

Q. Did you ever tell Mr. Hathaway or Mr. DeLuca of this diagnosis?

PRODUCED
JM - 83
MT-PWHD-005733

A. I did not.

Q. Do you know if anyone else did?

A. Yes.

Q. Who did tell them?

A. I think their foreman informed them.

Q. Who was that foreman at that time?

A. His name was -- he's a general foreman. His name was Charles Carmines.

Q. When did Mr. Carmines give them this advice, or tell them this?

A. I think, soon after the entry that is seen here.

Q. Within six months of this entry, at the most?

A. I'm certain of that.

Q. Were you present when he told them?

A. No.

Q. How do you know that he told them?

A. He told me afterwards what he did.

Q. How did Mr. Carmines come to know of this diagnosis?

A. I told him.

Q. Did you tell him with the intention that he would tell Mr. Hathaway and Mr. DeLuca?

A. Yes.

Q. Did you in fact ask him to do that?

A. I outlined the situation to him. What he did was on his own.

Q. But you did intend for these men to find out what their diagnosis was. Correct?

PRODUCED
JM - 83

MT-PWHD-005734

A. Yes.

Q. And Mr. Carmines later told you sometime within six months of May 20th, 1969, that he had in fact conveyed this information to those men; is that right?

A. Yes. The way he expressed it to me, he discussed it with them, and in the case of Hathaway, convinced him that it was best to get out of the trade.

Q. I think you mentioned earlier that both these men had had rather severe exposures. Do you know what kind of work these men did?

A. Hathaway was, the way I understood it, almost a ripout specialist, because he was unskilled in the trade and this was the only kind of work that he could do.

Q. And Mr. DeLuca?

A. I have no record -- I think he was a man that worked in the trade, and he probably was involved in all kinds of insulation work.

Q. Mr. Manning, you were telling us about four meetings that you had had. We had gotten up to the third meeting in Anaheim. Could you tell us where the fourth meeting was?

A. Yes. There was a fourth meeting held at the Elks' Club in Long Beach, in their auditorium.

Q. Approximately when was that meeting held?

A. I believe that meeting was held sometime in 1973. It may have been the summer of '73.

Q. Was this a union meeting?

A. This was a meeting also sponsored by the union and

PRODUCED
JM - 83
MT-PWHD-005735

paid for by them. I guess the expenses were. Dr. Selikoff himself came out here, along with Duncan Holaday, and Mr. Nickerson, or Dr. Nickerson, I think. And they presented in the auditorium a presentation that was in pretty fair depth, with slides and all kinds of material. Covered the subject very thoroughly, with some question-and-answer session afterwards. And might have lasted two and a half hours.

Q. Who from the shipyard attended that meeting?

A. There were various rank-and-file pipe coverers and insulators. Webb Ay. The foremen from the shipyard, I think, were there. There were other people from other insulation trades around in the area. I remember a Department of Labor individual. Tony Mangano was there.

Q. I'm sorry. Could you spell his name?

A. Tony, T-o-n-y, M-a-n-g-a-n-o.

This maybe was the OSHA office at that time in Long Beach.

Q. Was there anyone present from the rank and file in the boilermaker shop?

A. Yes. I recall one individual there who was interested in it. I could probably let you know his name. I think I can find it. It sticks in my mind that his name was Arnold, but I'm not sure. He later became the metal trades union president, but he was not then.

Q. His last name was Arnold, you think?

A. I think. I think.

Q. That's all right. We'll find it later on.

PRODUCED
JM - 83

MT-PWHD-005736

A. It's in there somewhere.

Q. Was Mr. Kreiger present at this meeting?

A. I don't remember him being there. I know Frank Nease was there, who was the superintendent of the shop. He was the one that arranged -- he belonged to the Elks, and Frank arranged for the auditorium.

Q. Was the general subject matter of this presentation the hazards associated with the installation and ripout of asbestos insulation products?

A. It covered the whole subject in some detail, including -- the most vivid memory I have of the whole thing is that Selikoff had a slide where this person had developed mesothelioma. They cut a section out of his side so you could see it, and this was in living color.

Q. Was the general subject matter, however, of the meeting the --

A. The entire subject --

Q. Let me finish the question, Mr. Manning.

The general subject matter was the hazards associated with the installation and ripout of asbestos insulation products?

A. That was included, including the results of exposure to asbestos. And there was some discussion about protective devices. As I recall, Duncan Holaday was very instrumental in getting the throwaway mask-type respirator accepted by the Bureau of Mines. There was some resistance, I guess. And it was his feeling as well as mine that these kind of respirators were more acceptable to

PRODUCED
JM - 83

MT-PWHD-005737

employees, and as I expressed before, something that is worn and they feel is acceptable to people is more -- far more effective than something that is not worn, but worn around the neck at most times.

Q. Mr. Manning, other than these four meetings that you've just told us about, do you know whether the people in Shop 56 had safety meetings on a regular basis?

A. They may have, but I'm not aware of them.

Q. You never attended any safety meetings in Shop 56 or of Shop 56 workers?

A. No.

Q. What about the people in the boilermaker shop? Did they have any safety meetings that you attended?

A. No. I think that what you're referring to, there was a safety meeting required where the foreman took 10 minutes and talked to the employees about safety periodically. This happened at all -- I think every foreman did this in every shop at every place, and I didn't attend these meetings, no.

Q. There were required 10-minute safety meetings?

A. This is my recollection that this is what happened. There were periodic safety meetings. My memory may be faulty, but I think the foremen were required to discuss safety with the employees on a periodic basis for a limited time. That's what we're talking about, I think.

MR. KAPPLER: Did you instruct the foreman on what to tell them?

THE WITNESS: Well, there was one time we

PRODUCED JM - 83

MT-PWHD-005738

brought in all the foremen and outlined the asbestos problem. We indoctrinated them in 1971.

Q. BY MS. HASKELL: With what frequency were these safety meetings required to be held?

A. I really have no idea. It's probably contained in the safety manual.

Q. Did you read the entire safety manual from cover to cover when you first came on board in '67?

A. No.

Q. Did you at any time ever read the entire safety manual?

A. No.

Q. Going back to this entry on March the 25th, I think you got up to the portion of the entry that had to deal with Selikoff's group. Would you read the rest of that entry, please.

A. What date is this?

Q. March the 25th. It's on paginated Page 84.

A. 84. March the 25th. "Took four dust samples" --

Q. Excuse me. Let me interrupt you. You read that paragraph. Would you read the next paragraph, please.

A. "Went aboard USS CANBERRA, USS BRADLEY, to lagger shop with tour." Yeah. "Reported to Owenby tour group."

Q. And then there's a list of numbers, "1, 2, 3, 4, 5." Correct?

A. Yes.

Q. There is nothing following those numbers, is there?

PRODUCED JM - 83

MT-PWHD-005739

A. No.

Q. What was supposed to go in those numbers?

A. I expect I put them down there for later reporting the concentrations. I never entered it.

Q. This was for the dust samples?

A. Yes.

Q. Do you have some explanation as to why you put down five numbers, but you only took four dust samples?

A. There would be five numbers, because there would be one count for the blank.

Q. For the blank?

A. Right.

Q. What would that be?

A. When you count dust, you count the total amount of dust, and then you have to -- in order to account for any extraneous material that may get in from somewhere else, why, you count -- in this case, it would be a membrane filter that had never been used for collecting anything, and going through the procedure and finding out if there is anything on there, if there were any fibers, that you would count that way, and that's considered a blank, and you would deduct the blank from the gross count. It was just part of the procedure.

Q. Would you look at the entry for March the 28th, please. It's on the same page, or the opposite page. Do you see that?

A. Yes.

Q. You had a call from somebody at Warehouse A

PRODUCED
JM - 83

MT-PWHD-005740

with respect to contaminated water. Is that right?

A. Yes.

Q. What kind of contamination was in the water system?

A. I don't know. Water contamination is in the area of sanitation, and I referred the whole thing, I think, to Lieutenant Truman, who was the sanitarian assigned to the Shipyard Naval Station and Supply Center as the sanitarian.

Q. Would you look at Page 85, please, the entry for April the 8th.

A. Yes.

Q. You went to a safety conference at the Los Angeles Ambassador Hotel on that date; is that correct?

A. That is correct.

Q. Then you went to some sort of lesson in the morning. Can you read that portion of the entry into the record?

A. Yeah. "Went to air pollution and water pollution session this morning. Visited exhibits. Attended Occupational Health meeting on plastics in the afternoon."

Q. So those lessons were part of the Safety Conference?

A. Sessions, yes.

MR. KAPPLER: Mr. Manning, on the same page there, you have the figures 224 and 225 on the opposite side, and then in your handwriting, I guess, you've got, "Silica Dust." That is all your handwriting, isn't it?

THE WITNESS: Where are you referring?

PRODUCED
JM - 83

MT-PWHD-005741

MR. STEINBERG: The April 2 entry.

THE WITNESS: Okay.

MR. KAPPLER: Is the "Silica Dust" in your handwriting?

THE WITNESS: Yes.

MR. KAPPLER: Then you have underlined "Sandblasting," and then the 224 and 225, that appears to be your handwriting also. Is that right?

THE WITNESS: I see no 224 or 225.

MS. HASKELL: The top of the pages.

THE WITNESS: Oh, yes.

MR. KAPPLER: I haven't been able to figure out what that 224 stands for. What do those figures stand for that appear throughout this --

THE WITNESS: That's the page number.

MR.KAPPLER: In your little book there?

THE WITNESS: Yeah.

MR. KAPPLER: Okay.

Q. BY MS. HASKELL: Mr. Manning, at this Safety Conference at the Los Angeles Ambassador Hotel on April the 8th, who sponsored that conference?

A. I think that was the Greater Los Angeles Safety Council.

Q. This was in April of '69. Correct?

A. Correct.

Q. At the air pollution session, was there a discussion of asbestos products or asbestos fibers in the air?

A. I have no recollection of this.

Q. Did anyone else from the shipyard attend that

PRODUCED
JM - 83

MT-PWHD-005742

conference?

A. Yes.

Q. Who?

A. Cliff Kreiger, Max Rudolph. May have been Ralph Violanti from the Safety Department.

Q. How do you spell his name?

A. R-a-l-p-h, V-i-o-l-a-n-t-i.

Q. Anybody else from the shipyard?

A. There no doubt were other people there that I can't remember. I do remember those people.

Q. Would you look at Page 87, please, of the paginated documents.

A. Yes.

Q. You have an entry on April the 16th with respect to going on board a specific ship which you later annotated in your log to indicate that you had been exposed to asbestos dust on that occasion. Is that correct?

A. Yes.

Q. What ship was that?

A. That was the USS GUIDE.

Q. G-u-i-d-e?

A. G-u-i-d-e.

Q. Then there are some initials and a number following the name of the ship. What are those initials and number?

A. MSO-447. That's a minesweeper, and the "O" refers to ocean. Minesweeper, Ocean, 447.

Q. Does that identify the boat specifically?

PRODUCED
JM - 83

MT-PWHD-005743

A. Yes.

Q. Do you recall what type of asbestos products you were exposed to on that occasion?

A. They were ripping out some insulation that had been installed in the engineering spaces. It's a small craft, and I found out about some ripout, and I went over there and took some samples.

Q. Was this ripout of preformed block?

A. My recollection is that it was preformed block or pipe covering, and some asbestos cloth.

Q. Was there any indication on any of these products that were being ripped out as to who the manufacturer of the product was?

A. No.

Q. On April the 17th, you also later indicated that you had been exposed to asbestos dust aboard the USS BRADLEY. Is that right?

A. Yes.

Q. What was the operation that was going on at that time on April the 17th, 1969, on the USS BRADLEY that exposed you to asbestos dust?

A. I have no specific recollection of this.

Q. On April the 21st -- that entry is on the same page -- in the last paragraph of that entry, you've indicated that you were exposed to asbestos dust in the pad shop. Isn't that right?

A. Yes.

Q. What kind of product was being used in the pad shop

PRODUCED
JUL - 83

MT-PWHD-005744

on that occasion?

A. Cloth, asbestos cloth. This no doubt was when I told Charlie Carmines about the two individuals we were discussing.

Q. On that date, on April the 21st, 1969?

A. This no doubt -- I talked at length with Charlie Carmines. This would indicate to me that this is when I told him about --

Q. Mr. Hathaway and Mr. DeLuca?

A. Right.

Q. It was shortly thereafter that Mr. Carmines told you that he had discussed the matter with Mr. Hathaway and Mr. DeLuca and told them about their diagnosis of asbestosis?

A. Yes.

Q. The entry for April the 22nd appears to me to be in handwriting other than yours. Is that correct or incorrect?

A. That is incorrect. It is in pencil.

Q. That is your handwriting?

A. Yes.

Q. Would you look at Page 88, please? The entry on April the 28th has been underlined in part in red ink with the notation "Asbestos Dust" added at a later date. Is that correct?

A. On what date?

Q. April the 28th, sir.

A. This is correct.

Q. Would you read that entire entry into the record

PRODUCED
JM - 83
MT-PWHD-005745

for us, please, exactly as it appears?

A. "Talked to Hal White about findings in plating shop. Took some dust samples in laggers pad shop. Went aboard CANBERRA. Visited firerooms to insulation work."

Q. What does that mean, that you went aboard the CANBERRA, visited firerooms to insulation work?

A. Apparently I was either looking for -- trying to find some work going on.

Q. Did you find some work going on that day?

A. I probably didn't, since I didn't take any samples.

Q. What operation was going on in the laggers shop when you took these dust samples?

A. These were the same normal procedures that were going on always. They were cutting asbestos cloth. They were trimming asbestos cloth. They were sewing asbestos cloth.

Q. They were making pads?

A. They were making pads.

Q. Would you read the entry of April the 29th on that page, please, as it appears?

A. Yes.

"Counted dust samples." I have two numbers. "0.26, 0.32, pad shop." These are --

Q. Just read it as it appears.

A. "Was informed to call Miller, 920. Did, but did not get him. Went to Pier 1, aboard laggers barge. Talked to some laggers. Looked into work schedule. Could not

PRODUCED
JM - 83

MT-PWHD-005746

find any ripout. Went to CANBERRA again to engine rooms and firerooms. No insulation work."

Q. Am I correct, sir, that there were some days when there was simply no insulation work going on at the shipyard?

A. Just simply some days that I couldn't find it. There possibly were some days that there was none going on. I wouldn't know for certain.

Q. These dust samples that you counted, are those the dust samples that you had done the previous day in the lagger shop?

A. Yes.

Q. These dust samples were .26 and .32?

A. That's correct.

Q. Is that fibers or --

A. That would have been in million particles per cubic foot at that time.

Q. At that time, the standard was how many million parts per cubic foot?

A. Five.

Q. So these measurements were way, way below the TLV in effect at that time; is that right?

A. Yes. These no doubt were reflected in reports that we talked about previously.

Q. These particular figures, like all of your tests, were not done on a time-weighted basis. Correct?

A. That is correct.

Q. They would be lower if they had been done on a

PRODUCED
JM - 83

MT-PWHD-005747

time-weighted basis?

A. In this case, where we're talking about a continuous operation, they would only be diluted by the time, probably, that they were coming and going from that location.

Q. And lunch. Correct?

A. That's right. The count in this situation would be fairly uniform, whether you counted it on a spot basis or you took all eight hours. Part of the reason, of course, that I don't have time-weighted averages is that in order to be valid, one must follow a worker for an 8-hour period, and under the conditions that I worked, I was just simply not able to do that and spend that much time; and these, in effect, are spot checks, and in no case was I able to do time-weighted-average work.

Q. What did you talk to these laggers about on that occasion?

A. I have no idea. No doubt, about --

MR. STEINBERG: You've answered the question.

THE WITNESS: Right.

Q. BY MS. HASKELL: Would you look at the entry of April the 30th?

A. Yes.

Q. Would you just read the first paragraph of that as it appears in the record?

A. "Started writing something in answer to NAVSHIPS letter to Shipyard Commander, requesting surveys on asbestos."

Q. "NAVSHIPS" is all capital letters,

PRODUCED IM - 83

MT-PWHD-005748

N-A-V-S-H-I-P-S?

A. Yes.

Q. What does that refer to?

A. That's Navy Ships Systems Command, which is a bureaucracy in Washington in the Navy that has jurisdiction over, among other things, shipyard facilities.

Q. NAVSHIPS had requested a survey or a series of surveys with respect to asbestos at the Long Beach Naval Shipyard?

A. Yes, that's what it says here.

Q. Do you recall what kind of surveys they wanted to have done at the shipyard?

A. No.

Q. Do you recall doing any surveys in response to this request?

A. What we have been discussing and going over is an ongoing sampling which bears on the subject.

Q. Do you recall doing any surveys specifically in response to a request from NAVSHIPS?

A. I don't know what the outcome of this was.

Q. That is not exactly my question. Do you recall having done any surveys specifically in response to a request from NAVSHIPS?

A. No.

Q. Mr. Manning, would you keep looking at Page 88 of these documents. Do you have that in front of you?

A. Yes.

Q. Mr. Kappler asked you earlier what the notations

PRODUCED
JM - 83

MT-PWHD-005749

were at the top of these pages, and you indicated to him that they were page numbers. Is that right?

A. Yes.

Q. Could you explain why two pages that are opposite each other bear respectively the numbers 230 and the number 237?

A. My bad handwriting. It's 231. 232 next.

Q. Thank you.

On Page 89, you've made several notations at a later date in red ink, I presume, underlining various places and indicating that you were exposed to asbestos dust on May the 1st. Is that correct?

A. Yes.

Q. Would you read those entries, please, exactly as they appear, into the record?

A. "May 1. Worked on report in morning. Went to PC&I pad shop in afternoon. Took air samples for asbestos dust."

Q. Do you recall what operation was going on in the pad shop on that occasion?

A. Making pads.

Q. On May the 2nd, you also indicated that you were exposed to asbestos dust at a later date by underlining and indicating "Asbestos Dust" in red ink. Is that correct?

A. Yes.

Q. Could you read that entry into the record?

A. "Went to USS BERKELEY and collected air samples for dust during insulation ripout. Counted dust samples in

PRODUCED JM - 83

MT-PWHD-005750

afternoon."

Q. Let me interrupt you for just a moment.

Do you recall what product was being ripped out on that occasion?

A. No, I don't.

Q. I don't need you to read the rest of that.

Did you take a trip during this period of time someplace?

A. Yes.

Q. Where did you go?

A. This was in May 1969. I went to the American Industrial Hygiene Conference held in St. Louis that year.

Q. On May the 3rd, there is an entry that you started to put together data for an asbestos report. Correct? May the 3rd.

A. Actually, "5," I think.

Q. I beg your pardon. That looks to you like May the 5th?

A. Yes.

Q. What kind of report was this?

A. I don't see anything about a report on May 5.

Q. Would you read the May 5 entry into the record, please?

A. Oh, I'm sorry.

Q. You do see your mention of an asbestos report?

A. "Started to put together data for asbestos report," correct.

Q. What kind of report was that?

A. This was a report already submitted to you, that

PRODUCED JM - 83

MT-PWHD-005751

was eventually sent out in August of this year.

Q. August of '69?

A. Right.

Q. Would you look at the entry of May the 8th, please, and read that into the record exactly as it appears, please.

A. "Went to Building 104 for demonstration of CO monitors. Used my CO sample to activate system, which shut down compressor and discharges holding tank to atmosphere. Had talk with George Tomer, MSA agent. He left one of his new respirators. Took respirator to Rudolph of 06 Shop and to Mr." -- I don't know.

Q. Geisler?

A. Geidler, something.

"Discussed respirator program. Went and saw Raymond, Shop 56, and discussed respirator program and other asbestos problems."

Q. Do you recall what the other asbestos problems were that you discussed?

A. Well, probably the problems associated with getting employees to wear respirators, the difficulties aboard ship of controlling the dispersions there during any kind of asbestos work. I think we probably went over several things. He was the foreman in charge of the whole 56 operation at that time.

Q. Do you recall any other items that you discussed with respect to problems related to the use of asbestos products?

PRODUCED JM - 83

MT-PWHD-005752

A. No.

Q. Would you turn to Page 90, please.

A. Yes.

Q. At the top of that page, there is a continuation, I believe, of the entry from May the 8th. Is that right?

A. Yes.

Q. Would you read that entry into the record, please?

A. "Had talk with C. Turner, Code 383, phone number 6479, who is charged with gathering information and writing answers to Naval Ship Engineering Center, Philadelphia Division, about our problems in combating asbestos hazards. He informed me that my letter for the Commander to NAVSHIPS was bucked down to him and never went out. I filled him in on the information and will send him a rough copy of asbestos report."

Q. Do you know whether your report of August '69 ever went out?

A. This apparently is -- I did, from the information I see here, write a report for NAVSHIPS and did send it to the shipyard commander, and he sent it down to these people for review, I suspect.

Q. Did you subsequently learn after April of 1969 that your report had in fact been sent to NAVSHIPS?

A. I never found out what happened.

Q. Other than this one conversation that you had with C. Turner -- is that a man or woman, do you know?

A. I do not know.

Q. Other than this conversation that you had with

PRODUCED
JM - 83

MT-PWHD-005753

C. Turner about your report and about his or her responsibilities in responding to the NAVSHIPS letter with respect to asbestos, did you have any other conversations with this C. Turner person?

A. I had other conversations. I now remember the man vaguely. We had some ongoing conversations by phone and so forth. What happened was, of course, that I was consulted in the matter but actually did not have the responsibility for sending out this report, and the man that did used my information to submit to the shipyard commander. His name is mentioned April the 7th, I see.

Q. Is it your understanding that this report that reference is made to in this entry was produced by you sometime in the last week?

A. Yes.

Q. Could you, without too much time and trouble, find that report for me in the documents that were produced?

A. I got a rough copy out, it says here. This is the same report of August that we're talking about.

Q. Can you lay your hands on that copy of the report?

A. You have the copy.

MS. HASKELL: Let's go off the record for just a minute.

(A discussion is held off the record.)

Q. BY MS. HASKELL: Mr. Manning, while we were off the record, you indicated to me that your memorandum of September 4, 1969, which has previously been marked as Defendants' Exhibit C to your deposition, is the report which you believe is referred to in this entry of May the 8th, 1969.

PRODUCED
JM - 83

MT-PWHD-005754

Is that correct?

A. Yes.

Q. Did you write that report in several drafts?

A. I did do several drafts.

Q. Do you know what became of the several drafts?

A. Probably thrown out.

Q. Is that your custom and practice, to throw out your drafts as you rewrote them?

A. Custom would probably be in most instances to keep the final copy and throw out the drafts.

Q. Mr. Manning, in preparing this log or this diary, did you, during the course of a day, make notes on various pieces of paper or in some notebook that you then transformed into entries into this log or diary?

A. I carried a notebook habitually in my pocket. When something came up or some data, I would makes notes in this notebook.

Q. Did you keep those notebooks?

A. I don't think I have those.

Q. Mr. Manning, on Page 90, the first entry on that page is a continuation from May the 8th, from the prior page. Is that right?

A. Number what page?

Q. Page 90. In the upper left-hand corner, that entry which you've just recently read with respect to Mr. Turner --

A. Yes.

Q. -- is a continuation from the May 8, 1969, entry

PRODUCED
JM - 83

MT-PWHD-005755

on the previous page. Correct?

A. Yes.

Q. Can you explain to me, sir, why the entry following the May 8, 1969, entry is dated April the 9th?

A. It's a mistake. It's actually May 9.

Q. You simply noted the wrong month?

A. That's correct.

Q. Would that be true also of the following entry, which makes reference to April the 11th to April the 16th?

A. That's true.

Q. Between the dates of what appears in your calendar or your diary to be April 11 to April 16, but which is actually May 11 to May 16, you attended a conference of the AIHA. Is that correct?

A. That's correct.

Q. That is the American Industrial Hygiene Association?

A. Yes.

Q. This meeting was held in Pennsylvania -- or Denver? Excuse me.

A. That's right. My memory failed me. This conference was held in Denver, and the one the prior year was held in St. Louis. My mistake.

Q. This conference that you attended in May of 1969 in Denver, were there other people from the Long Beach Naval Shipyard present at that conference?

A. No.

Q. Were there people present representing various unions?

PRODUCED
JM - 83
MT-PWHD-005756

A. Yes.

Q. Which unions were represented at that conference?

A. I don't know.

Q. Were there any manufacturers of asbestos products present at that conference or convention?

A. Their industrial hygienists were there, I think.

Q. Do you recall the names of any of the companies that manufacture asbestos products whose industrial hygienists were present at this conference or convention?

A. Bob Rietze was there.

Q. He is from J-M. Correct?

A. That's correct.

Q. Anybody else that you recall?

A. That's the only name I recall.

Q. For the record, and to satisfy Mr. McKay's curiosity, J-M indicates to you Johns-Manville. Correct?

A. That's correct.

Q. Thank you.

Your report or your entry for May the 9th of 1969 indicates to my reading that you made some changes in your asbestos report in light of what was said in Denver, I presume, at the AIHA convention. Is that right?

A. Yes.

Q. What kind of changes did you have to make as a result of the information that you learned at that convention?

A. I don't know.

Q. Would you take a moment and review your report

PRODUCED
JM - 83
MT-PWHD-005757

as in final form or as it was finally printed up or typed up in September of 1969, and tell me if there are any portions of that report which you feel were changed or added to as a result of the convention in Denver in May of 1969?

A. At this date, I couldn't say what was changed. It went through more revision after this, and I would only be guessing, but I had information that I got there that changed my outlook somewhat, and I must have wanted to change the report.

Q. You don't think reviewing the document right now would refresh your recollection as to what you learned at that meeting?

A. No.

Q. Would you take a look at Page 91.

A. Excuse me. I will make comment on that May -- I just remembered something. I did hear Dr. Selikoff in person, I recall, in Denver on a Friday morning, and I must have heard some additional data that impressed me. That's all I know about it now.

Q. Would you take a look at Page 91 of the paginated documents.

A. Yes.

Q. The entry for May the 21st, would you read that first complete sentence there?

A. "Spent most of day with Lieutenant Weeks and his sewer pit problem. Took air sample results" --

Q. You don't need to read the results into the record.

PRODUCED
JM - 83

MT-PWHD-005758

You later wrote in red ink underlining the words "his sewer pit" and drew a little arrow and wrote in red ink, "90 foot down," or "90 feet down." Isn't that right?

A. Yes.

Q. Was this the occasion that you talked to us about last week where you had to climb down a ladder 90 feet?

A. Yes.

Q. And you had some difficulty doing this?

A. Yes.

Q. This was in May of 1969?

A. Yes.

Q. Okay. Would you read the entry on Page 92 for the date May 27th, please, into the record.

A. Yes.

Q. Go ahead and read it, if you would.

A. "Filed reference material and correspondence. Gave Commander Smith asbestos report for comment. Sent rad photodosimetry letter to Subic Bay. Called Shop 41, 31, 56, to have lead-exposed employees in on Thursday for coproporphyrins."

Q. What did the people in Shop 56 do that required them to have these lead-exposure tests?

A. The actual fact was, it didn't do anything. In years past, these people may have been exposed to lead, but they no longer were, in most instances.

Q. Well, in the instances where they were exposed to lead, what jobs were they doing that exposed them to lead?

A. The only lead exposures while I was there was 41

PRODUCED JM - 83

MT-PWHD-005759

shop, and they were melting down lead-containing molds, and we discussed this previously.

Q. 41 is the foundry?

A. Foundry, correct.

Q. What other trades are in Shop 41 besides the foundry?

A. Welders.

You will notice I submitted my report the day after Smith arrived.

Q. Beg your pardon?

A. Commander Smith arrived on the 26th, and I gave him the report on the 27th.

Q. This was the report that was later revised several times and became embodied in what is now Defendants' Exhibit C to your deposition?

A. Yes.

Q. Would you read the entry for June the 4th, please, which also appears on paginated document Page 92.

A. Yes. What date?

Q. June the 4th. Would you read it into the record, please?

A. "Read literature on lung symptoms in asbestos exposure. Asked for NAVSHIPS note on asbestos that I found out about and never saw. Went to Pier 6 and to NSC. Checked on barrier cream and had" -- I don't know.

Q. Does that say "cleaners"?

A. Might be.

-- "cleaners in 03 shop. Used Pro Tek, Sta Lub. Typed

PRODUCED
JM - 83
MT-PWHD-005760

up some physical exam information on laggers."

Q. Pro Tek is a product name spelled P-r-o, capital T-e-k?

A. That's correct.

Q. Sta Lub is also a product name spelled S-t-a, capital L-u-b?

A. That is correct.

Q. What is this NAVSHIP note on asbestos that you found out about but had never seen before?

A. I don't know.

Q. Does this indicate to you that there were some requirements with respect to the handling of asbestos products in the shipyard that had been in existence for some period of time but which you had not been advised of?

A. Yes.

Q. You don't recall anything more specifically about that particular entry?

A. No.

Q. Do you recall how you found out about this NAVSHIPS note?

A. No. This was not an isolated case.

Q. There were many instances where there were regulations with respect to products in the shipyard or handling of products in the shipyard that you just didn't come across?

A. There were times when important documents were not routed to my desk and were sent to the wrong places or this sort of thing happened. It was a

PRODUCED
JM - 83

MT-PWHD-005761

matter of routing, I think. Some breakdown here.

Q. Would that also indicate that these particular documents didn't get incorporated into the shipyard safety manual?

A. I have no knowledge of that.

Q. You didn't read the shipyard safety manual on an ongoing basis from time to time?

A. There were many notices of this type that came into the shipyard from various sources, and as I explained, not always did I see them and read them -- not always were they routed to my desk. I can't explain why this was not done, but at times it happened.

Q. Mr. Manning, did you in fact review the shipyard safety manual on a periodic basis?

A. Yes.

Q. From cover to cover?

A. No.

Q. What portions of the shipyard safety manual did you review on a periodic basis?

A. Things that pertained to industrial hygiene, hazardous materials, things pertaining to noise hazard, radiation, sometimes labeling.

Q. On these occasions when things were either misrouted or not routed to your attention, how did you later come to learn of them?

A. Oh, I'd get around pretty well in the shipyard, and various ways. I remember I got wind of the hearing conservation report which should have been sent down to me in

PRODUCED JM - 83

MT-PWHD-005762

a discussion aboard ship with a commander aboard ship. Everybody in the Navy got one, in command of a ship or command of a shipyard, and I found out that he had his copy and borrowed -- got his copy. And apparently the copy was sent to the shipyard commander and it was not yet routed down to me. These things happen in bureaucracies.

Q. Generally there was a time lag from the time that things reached the shipyard until they reached your desk?

A. Yes, if they were sent to the shipyard commander.

Q. On an average, how long was that time lag?

A. I couldn't say. It was indefinite.

Q. By "indefinite," do you mean sometimes the things just never ever reached you?

A. This is a good possibility.

Q. Would you turn to Page 94, please, of the paginated documents. And on the right-hand side page of those documents, do you see an entry for June the 17th?

A. Yes.

Q. That indicates that you wrote up asbestos forms for exposed workers; is that right?

A. Yes.

Q. What is an asbestos form?

A. I don't know what this refers to, exactly.

Q. You don't recall specifically a form used for asbestos-exposed workers?

A. I vaguely remember making up some kind of form. This may have been a form that I was going to use to record X-ray exposure and pulmonary function.

PRODUCED JM - 83

MT-PWHD-005763

Q. Were you also going to interview the individual workers to determine their ages and other pertinent information?

A. This pertinent information was available to me.

Q. Did you at any time undertake to interview individual workers with respect to their individual working conditions for the purposes of providing that information to somebody else?

A. No.

Q. Did you ever undertake to interview individual asbestos workers or people working with asbestos insulation products for the purposes of logging that information for whatever purpose?

A. No.

Q. Would you read the second sentence of that paragraph?

A. June 18th?

Q. June the 17th.

A. "Talked to Larry Norton about proposed NSC survey."

Q. Who was Larry Norton?

A. He was a man that was in charge of safety, I think, in the Naval Supply Center. He did that on a part-time basis.

Q. What did he do the other time?

A. I don't really remember.

Q. What is NSC the abbreviation for?

A. Naval Supply Center.

Q. This was simply a survey that you were going to

PRODUCED JM - 83

MT-PWHD-005764

do at the Naval Supply Center?

A. Yes.

Q. To determine what?

A. He had, he thought, various operations around in the center that he wanted me to look at and evaluate the situation. Try and recognize and evaluate, and if needed, to control the situation. There was a degreaser, I remember.

Q. Did he ask you to undertake any survey with respect to specific asbestos products that were being held at the Naval Supply Center?

A. No.

Q. Would you read the entry of June the 18th, which appears on the same page, into the record exactly as it appears, please.

A. "Took asbestos survey to Raymond for comment. Gave Marks advice on supposed vapor exposure incident Sunday night."

Q. Let me stop you right there. What was this vapor exposure incident that occurred on Sunday night?

A. I can't say from this. This goes on to make some kind of -- this was a painter foreman. It was a paint vapor problem, since that's what he did.

Q. It indicates that the man had a fever on Tuesday, and on Wednesday, had hysteria. Is that what that says?

A. Yeah. "Man had fever on Tuesday, and Wednesday, hysteria." Out of his mind.

PRODUCED
JM - 83

MT-PWHD-005765

Q. You didn't determine what kind of vapor this man was exposed to?

A. I ordinarily, in the course of my business, would try to find out what type of vapor it was.

Q. Did you find out what kind of vapor it was in this particular instance?

A. I did, I'm sure, but I don't have it noted.

Q. Would you read the rest of that entry, please, beginning with the sentence, "Got copy of."

A. "Got copy of report written by C. Turner to Nav Sec. Took my" -- don't know what that says. "Took my stuff."

Q. Does that indicate to you that Mr. Turner wrote his own report, incorporating your previous reports, or the drafts of your report?

A. Yes.

Q. Is the document that you've produced as Defendants' Exhibit C a document that you wrote or a document that Mr. Turner wrote?

A. Defendants' C is a document that I wrote. We were talking about some other report here.

Q. What was that report on?

A. We were talking about that NAVSHIPS request for NAVSHIPS material. It was turned over to C. Turner, who wrote something on it and gave it to me for me to look at, and then probably gave it to the shipyard commander for routing to NAVSHIPS Systems Command, apparently, in Philadelphia.

PRODUCED
JM - 83
MT-PWHD-005766

Q. This is not the information with respect to the asbestos survey?

A. No, not this number C here. It was something else they wanted. I don't know what it was exactly.

Q. On June the 20th of 1969, on Page 95, there's an entry that you took the day off sick.

A. Yes.

Q. Do you recall what your problem was on that particular day that required you to take the day off sick?

A. No.

The next entry, here comes the visitors that you asked about.

Q. Before we get to the visitors, did you become sick on June the 20th as a result of investigating this vapor problem on June the 18th?

A. I don't think so.

Q. You don't recall, however, what the nature of your illness was?

A. No.

Q. Do you know if you saw a doctor for that illness?

A. I don't know that, either.

Q. Would you read the entry for June the 23rd, when the visitors were coming?

A. Yes. "Had visitors, Mr." -- C-h-e-r-o-b-i-e-r -- "NAVSHIPS Engineering Command, Hyattsville, Maryland, and Mr. Walters and" -- A-m-m-u-t-h -- "from NAVSHIPS, Philadelphia Division. I spent most of the day with them on asbestos problems."

PRODUCED
JM - 83

MT-PWHD-005767

Q. What particular problems were they interested in learning about?

A. Well, they wanted to know -- they wanted to be filled in on the whole matter, the comprehensive problems in the shipyard. They had been charged by an admiral to investigate these problems and solve the situation.

Q. Did they make some recommendations to you as to what should be done to solve this whole situation?

A. I remember specifically that this Cherobier had written an article, where he was putting respirators on everything in sight, and more respirators. And this was about the extent of their contribution.

Q. These people generally recommended, or the sole recommendation that they made was that all people be required to wear respirators?

A. Yes.

Q. Did that include people working in and around employees using asbestos products, as well as employees actually using asbestos products?

A. I don't know that specifically.

Q. Did you actually inspect some asbestos installations with these gentlemen on that occasion?

A. Yes.

Q. Did you inspect some ripout operations with these gentlemen on that occasion?

A. I'm not certain, but I know there was some fabricating work aboard ship that we looked at.

Q. When you say "fabricating work," what do you mean

PRODUCED
JM - 83

MT-PWHD-005768

by that?

A. That's putting it on.

Q. What kind of products were being put onto the ship on that occasion?

A. There was some preformed asbestos material. There was some cement-type material being put on with a trowel. And I think they used asbestos cloth to finish it.

Q. Was this preformed block or preformed pipe covering?

A. I believe, preformed pipe covering.

Q. Do you recall whose product it was that was being used on that occasion?

A. No.

Q. Was there any designation or logo on the preformed pipe covering to indicate to you whose product it was?

A. No.

Q. Do you recall whose cement was being used on that occasion?

A. I think it was Eagle-Picher cement.

Q. Do you know whether this was asbestos cement?

A. Yes.

Q. Was it asbestos cement?

A. Yes.

Q. Do you know whose asbestos cloth was being used on that occasion?

A. No.

PRODUCED JM - 83

MT-PWHD-005769

Q. Was there any designation or logo on the cloth to indicate to you whose cloth it was?

A. No.

Q. On that same paginated Page 95, on the right-hand side of that page, for the entry of June the 27th, would you read that into the record, please?

A. "Started to compile data for quarterly report. I went into yard to find jitney that patient complained of exhaust gas. Observed the equipment. Will take samples later. Had call from Paikai about asbestos investigation on use of product for hot caps."

Q. What is this gentleman or lady's name?

A. This man was a foundry foreman.

Q. What was his name?

A. Paikai, P-a-i-k-a-i.

Q. He requested an investigation of the use of a particular type of asbestos product for hot caps?

A. Yes.

Q. What are hot caps?

A. In the pouring of castings, the metal is poured into a funnel-shaped hole that leads to what is called a riser, which then -- the metal flows then down into the body of the mold. Naturally, the contact with air, there's cooling here, and as the metal cools and contracts inside this riser, should be kept liquid so that the metal can keep on flowing till it becomes solid. So that some kind of insulation or heating is required in the top of these risers in order to keep the metal molten. There had been some other

PRODUCED
JM - 83

MT-PWHD-005770

method used prior to this, and Paikai was trying to find something to substitute for that.

Q. Was he trying to find something to substitute for asbestos or was he trying to substitute asbestos for a prior method?

A. He was trying to substitute asbestos for a prior method.

Q. Were you able to recommend to him a particular asbestos product that could be used for that?

A. I told him to stop it.

Q. What kind of asbestos product was he trying to use for this application?

A. He had used some kind of 100 percent asbestos mixture that he bought that were pure fibers, mostly.

Q. Did he buy this himself outside of the shipyard?

A. This was something that he did on his own, and had no idea there was any problem.

Q. Did he ask you to investigate that?

A. He came over -- he asked me to come over and look at it.

Q. Did he tell you why he wanted you to come look at it?

A. He wanted to make sure it was a safe operation.

Q. Did he indicate to you that he had some concern about the use of asbestos products?

A. No. There had been complaints about the previous method, so that he was looking for something that he thought was a better way of doing it, and he stumbled

PRODUCED JM - 83

MT-PWHD-005771

onto this, and he had no prior knowledge of the dangers involved, and as soon as I found out about it, I stopped it.

Q. Did you explain to him that there was some hazard involved in using 100 percent asbestos pure fibers for this application?

A. Immediately.

Q. Did you tell him what those hazards were?

A. Yes.

Q. What did you tell him?

A. I told him that he had substituted something that was far worse than he had at the time. He was about ready to contaminate the whole foundry with something that would cause lung damage, and I think that's about as far -- severe lung damage, and possibly cancer.

Q. Do you recall on the occasion that he purchased this 100 percent asbestos mixture of pure fibers whether the bag or the container for those fibers was present when you got there?

A. I didn't see the bag.

Q. You don't know who manufactured the product that he was attempting to use on that occasion?

A. No.

Q. On Page 96, the paginated page, on the right-hand side, the bottom entry for July the 7th, do you see that entry?

A. Yes.

Q. Would you read the first paragraph of that entry into the record, exactly as it appears, please.

PRODUCED JM - 83

MT-PWHD-005772

A. "Ennis," I think, "Shop 41, called to discuss Bene Sug, asbestos instead of Feedex for covering risers on molds. Told him to read it to me."

Q. Ennis is E-n-n-i-s?

A. Yes.

Q. This was a man who worked in Shop 41?

A. Yes.

Q. Shop 41 is the foundry?

A. In part.

Q. Did this man work with Mr. Paikai?

A. He may or may not have.

Q. What did he want to talk to you about?

A. Apparently he is the one that made this suggestion to use asbestos for the type of application that we had discussed. I used the words "risers on molds." This was the same thing discussed prior.

Q. He wanted to substitute some kind of asbestos product for a product called Feedex, F-e-e-d-e-x?

A. That is true.

Q. Do you know what Feedex is comprised of?

A. Yes.

Q. What is that?

A. Feedex was mostly aluminum powder.

Q. In having this conversation with Mr. Ennis, he made some mention to you of a bene. sug.?

A. Yes.

Q. I think you told me before, but I've forgotten. What does "bene. sug." stand for?

PRODUCED
JM - 83

MT-PWHD-005773

A. Beneficial suggestion.

Q. This is something the Navy publishes?

A. This was an ongoing program they had in all shipyards, I think, whereby employees could have the opportunity to submit suggestions that they thought might be helpful in either reducing cost or reducing health hazards, in this case he thought, and this kind of thing; and sometimes if a suggestion was valid and accepted, there was some kind of monetary value put on the savings, and there was a cash reward for this sort of thing.

Q. Then it became incorporated as a bene. sug.?

A. Incorporated in the procedures in the shipyard if it was accepted and went all the way through, yes.

Q. This man, Mr. Ennis, thought that he would be solving a health problem by substituting asbestos for Feedex?

A. Apparently.

Q. Was there some health hazard associated with the use of Feedex?

A. Nothing very much.

Q. Are you certain that he wasn't simply interested in substituting asbestos instead of Feedex for the purpose of efficiency, as opposed to eliminating a health hazard?

A. No. This operation with Feedex caused a large cloud of aluminum oxide to be dispersed in the air, and this was very visible and alarmed the employees and caused complaints, although aluminum oxide, as we discussed before,

PRODUCED
JM - 83

MT-PWHD-005774

is a nuisance dust, nuisance fume in this case, and has no appreciable adverse effects on health, although it was a spectacular thing that happened, and momentarily spread fumes throughout the area, and this was of a lot of concern and a lot of complaint, and they thought they were doing a good thing.

Q. Are aluminum oxide fumes irritating to the mucous membrane?

A. No.

MS. HASKELL: Seeing as how we're done with the first volume and it is almost 1:00 o'clock --

MR. STEINBERG: You mean you're done with the first volume?

MS. HASKELL: Seeing as how I am done with the first volume -- by "we," I meant myself and Mr. Manning -- this is a good time to take a break.

We will reconvene tomorrow at 9:00. Correct?

MR. STEINBERG: Correct.

MS. HASKELL: And we will have those documents here?

MR. STEINBERG: Yes, we will have the documents --

MS. HASKELL: Is it possible to have the documents here earlier than 9:00?

MR. STEINBERG: Yes. Well, I can probably get them here a little earlier. Not much. I'll try to make it by a quarter to 9:00, 20 minutes to 9:00.

MS. HASKELL: If you could. It would facilitate things if the court reporter could mark them beforehand.

MR. STEINBERG: In fact, tomorrow I will try to make

PRODUCED
JM - 83

MT-PWHD-005775

every effort to be here at 8:30.

MS. HASKELL: Thank you very much.

(The deposition recessed at 12:57 p.m.)

(I certify under penalty of perjury that the foregoing is true and correct.)

_____ _____
DATE SHELDON H. MANNING

AT _____, California.
CITY

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JM - 83

MT-PWHD-005776

STATE OF CALIFORNIA) SS

I, Lucia Moskal, CSR, a Notary Public in and for the State of California, do hereby certify:

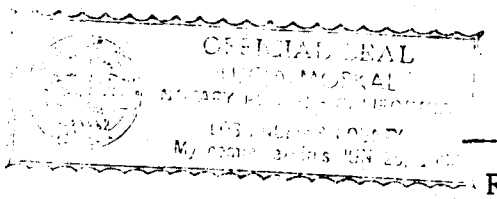
That, prior to being examined, the witness named in the foregoing deposition was by me duly sworn to testify the truth, the whole truth and nothing but the truth.

That said deposition was taken down by me in shorthand at the time and place therein named and thereafter reduced to typewriting under my direction.

I further certify that it was stipulated by and between counsel that the signature of said witness to said deposition may be waived.

I further certify that I have no interest in the event of the action.

WITNESS my hand and seal this 7th day of March, 1979.



LUCIA MOSKAL CSR 1222
Registered Professional Reporter
Notary Public in and for
the State of California.

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MT-PWHD-005777

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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

FILE COPY

WALTER C. RIGSBY, JOSEPH K. KLOSE and SHELDON H. MANNING,

Plaintiffs,

vs.

JOHNS-MANVILLE, etc., et al.,

Defendants.

No. C 151 947

EXHIBITS TO THE DEPOSITION OF SHELDON H. MANNING, VOLUME V, taken Monday, March 5, 1979, at Los Angeles, California, before Lucia Moskal, CSR, a Notary Public.

Reported by:
Lucia Moskal, CSR 1222

No. LA-770-79

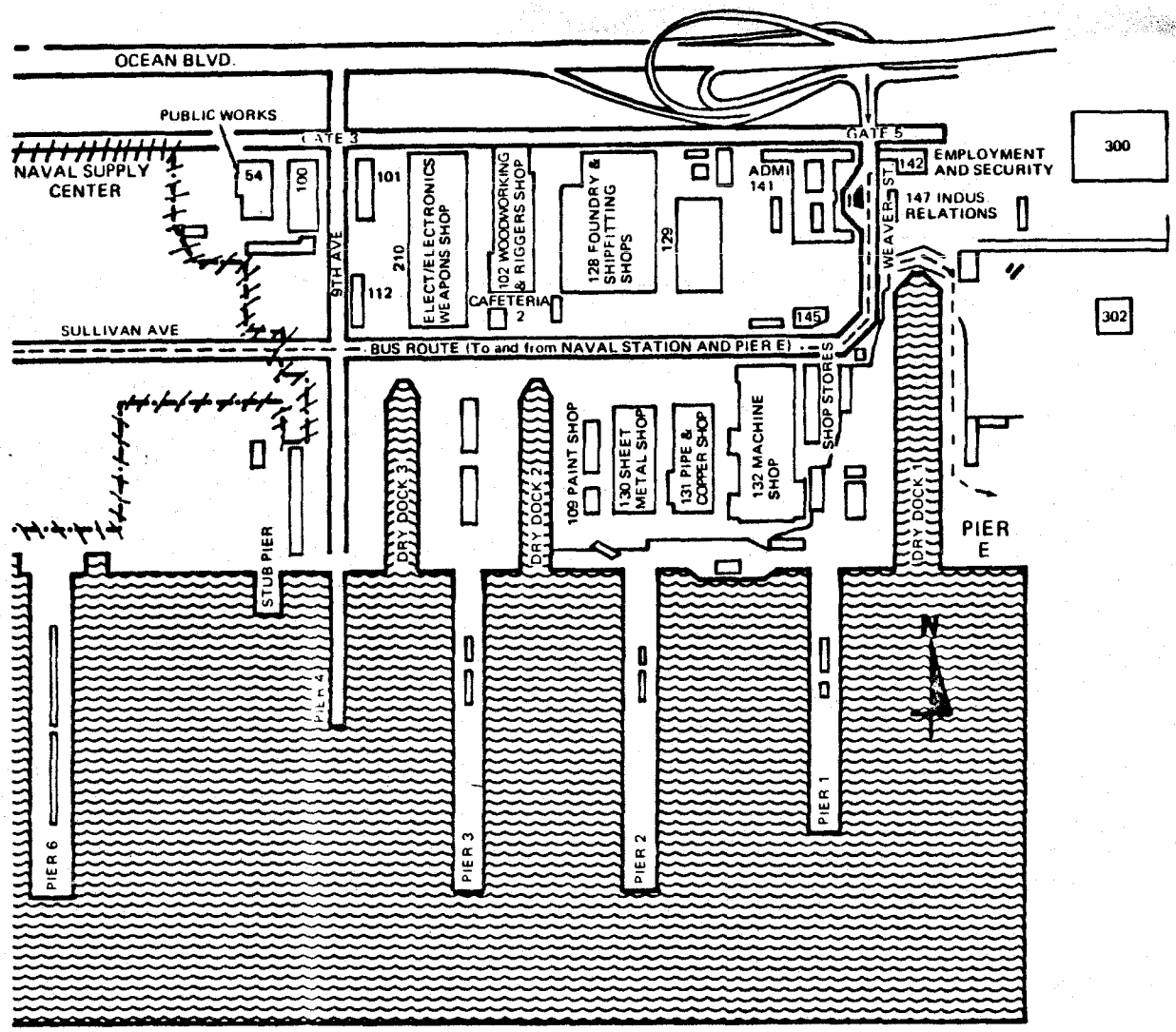
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3436 N. Figueroa	654 N. Sepulveda	523 N. Grand	326 Broadway
223-1191	472-9578	547-6169	233-6227

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JM - 83

Rigsby v. JM
Exhibits - 2
Manning depo (V)

MT-PWHD-005778



LONG BEACH NAVAL SHIPYARD

LONG BEACH, CALIFORNIA

Depts LL for Jel
3-5-79
1 Wit: Manning

PRODUCED
JM - 83

MT-PWHD-005779

MT-PWHD-005780

PRODUCED JM - 83

LONG BEACH NAVAL SHIPYARD

MISSION

The official mission of the Long Beach Naval Shipyard is "To provide logistic support for assigned ships and service craft; to perform authorized work in connection with construction, conversion, repair, alteration, dry-docking, and outfitting of ships and craft as assigned; to perform manufacturing, research, development, and test work, as assigned; and to provide services and material to other activities and units, as directed by competent authority."

HISTORY

Long Beach Naval Shipyard is one of ten Naval Shipyards located on the East and West Coasts of Continental United States and on the island of Oahu in Hawaii. Congress authorized the establishment of the Naval Dry Docks, Terminal Island, in 1940, and the first ship was dry-docked in 1942 at what is now the Long Beach Naval Shipyard.

During World War II the Naval Dry Docks provided routine and battle damage repairs to a parade of tankers, cargo ships, troop transports, destroyers and cruisers. Peak employment of 16,000 civilian employees was reached in August, 1945. The Activity's name was changed to the Terminal Island Naval Shipyard in November, 1945, and then to Long Beach Naval Shipyard in March, 1948.

In October, 1955, the Shipyard began to absorb the Naval Supply Depot, San Pedro, and subsequently became a major supplying activity. During the late fifties and early sixties Long Beach Naval Shipyard made significant contributions to the Military Assistance Program, the Fleet Rehabilitation and Modernization Program and the Polaris Missile Program.

In April, 1964, the Service-Wide Supply support functions of the Shipyard were transferred to the newly established U. S. Naval Supply Center, Long Beach. That transfer represented a major step in the divestment of non-industrial functions which had been assumed by the Shipyard since the end

BACKGROUND

The Long Beach Naval Shipyard is the second largest industry in the City of Long Beach and, with its ships, personnel, and projects, provides support to the economy of the greater Los Angeles area, as well as of Long Beach, in many ways. Within an area of 122 acres, the Shipyard facilities include three graving docks, four industrial piers, and one of the largest self-propelled floating cranes in the world.

This Shipyard is equipped with facilities and skills capable of performing all structural, sheetmetal, boiler, rigging, electronics, electrical, lagging, ordnance, sandblasting, welding, machining, woodworking, painting, pipefitting, and other work incidental to the overhaul and repair of surface ships. The Shipyard possesses complete design, engineering, and planning capabilities to support its industrial work. In keeping with the latest technology, this shipyard acquired a numerical control machine in 1964 and has since added nine more numerical control machines to its facilities. The capability of transmitting programs and receiving computer tapes in just minutes from the McDonnel-Douglas computer makes it possible to machine unavailable ship parts to meet urgent repair schedules.

The Shipyard provides an apprentice training program with approximately 400 personnel participating in this training for twenty-one different trades each year to meet the objective of maintaining basic skills. As part of the career development program implemented by this Shipyard, more than 600 personnel attend classes in the training department after working hours to increase their skill knowledge and acquire college credits.

Since Pollution and Environmental Control is a high priority item today, this Shipyard has established a permanent Environmental Improvement Program for protecting environment and for maintaining high quality industrial safety standards. The Environmental Improvement Committee meets regularly to study potentially offending processes and determine necessary controls. As a part of the Shipyard's continuing program of environmental improvement, the Engineering Division and Service Group have been conducting evaluative tests on hydro-blast equipment as a substitute for open air sandblasting in drydocks. Another such improvement is the use of Bricksaws with dust collectors attached to stop dust pollution in cutting firebrick.

To meet the critical need to improve waterfront capabilities and facilities and to provide sufficient flexibility to meet workload changes and technological advances required for fleet support, this Shipyard has completed Modernization and Military Construction Projects costing approximately 7 million dollars since 1968. These projects include, in part, Pier 6 Utilities, Service Building Pier E, 1st Increment of Electronic Weapons Precision facility and several environmental control projects. Currently approximately 20 million dollars in construction is underway.

The Long Beach Naval Shipyard enjoys an excellent reputation among its fleet customers. The past and current performance in terms of producing timely, economical and quality work coupled with a zeal in responsiveness contributes to this reputation.

The workload of this Shipyard consists largely of overhaul and maintenance of surface ships. The yard is capable of completely overhauling all non-nuclear surface ships in the Navy. During fiscal year 1972 this Shipyard repaired 148 ships.

FACTS FOR FISCAL YEAR 1972

Work Force			
Military	46		
Civilian	6,397		
Workload		**Mandays**	**No. of Ships**
Regular Overhauls		913,000	22
Restricted & Techn. Avbltys.		82,000	101
Miscellaneous Shipwork		39,000	25
Other Production Work		125,000	
Type of Ships			
Carriers		0	
Cruisers		0	
Destroyers		33	
Amphibious War Fare		33	
Mine War Fare		15	
Patrol & Ocean Escorts		32	
Auxiliary		33	
Other		2	
Total		148	
Volume of Business			
Materials & Services		$36,278,000	
Salaries & Wages		92,065,000	
Total		$128,343,000	

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JM - 83

MT-PWHD-005781

LONG BEACH NAVAL SHIPYARD

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The Shipyard provides an apprentice training program with approximately 400 personnel participating in this training for twenty-one different trades each year to meet the objective of maintaining basic skills. As part of the career development program implemented by this Shipyard, more than 600 personnel attend classes in the training department after working hours to increase their skill knowledge and acquire college credits.

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To meet the critical need to improve waterfront capabilities and facilities and to provide sufficient flexibility to meet workload changes and technological advances required for fleet support, this Shipyard has completed Modernization and Military Construction Projects costing approximately 7 million dollars since 1968. These projects include, in part, Pier 6 Utilities, Service Building Pier E, 1st Increment of Electronic Weapons Precision facility and several environmental control projects. Currently approximately 20 million dollars in construction is underway.

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Total		148	
Volume of Business			
Materials & Services		$36,278,000	
Salaries & Wages		92,065,000	
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LONG BEACH NAVAL SHIPYARD

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JM - 83

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During World War II the Naval Dry Docks provided routine and battle damage repairs to a parade of tankers, cargo ships, troop transports, destroyers and cruisers. Peak employment of 16,000 civilian employees was reached in August, 1945. The Activity's name was changed to the Terminal Island Naval Shipyard in November, 1945, and then to Long Beach Naval Shipyard in March, 1948.

In October, 1955, the Shipyard began to absorb the Naval Supply Depot, San Pedro, and subsequently became a major supplying activity. During the late fifties and early sixties Long Beach Naval Shipyard made significant contributions to the Military Assistance Program, the Fleet Rehabilitation and Modernization Program and the Polaris Missile Program.

In April, 1964, the Service Wide Supply support functions of the Shipyard were transferred to the newly established U. S. Naval Supply Center, Long Beach. That transfer represented a major step in the divestment of non-industrial functions which had been assumed by the Shipyard since the end of

BACKGROUND

The Long Beach Naval Shipyard is the second largest industry in the City of Long Beach and, with its ships, personnel, and projects, provides support to the economy of the greater Los Angeles area, as well as of Long Beach, in many ways. Within an area of 122 acres, the Shipyard facilities include three graving docks, four industrial piers, and one of the largest self-propelled floating cranes in the world.

This Shipyard is equipped with facilities and skills capable of performing all structural, sheetmetal, boiler, rigging, electronics, electrical, lagging, ordnance, sandblasting, welding, machining, woodworking, painting, pipefitting, and other work incidental to the overhaul and repair of surface ships. The Shipyard possesses complete design, engineering, and planning capabilities to support its industrial work. In keeping with the latest technology, this shipyard acquired a numerical control machine in 1964 and has since added nine more numerical control machines to its facilities. The capability of transmitting programs and receiving computer tapes in just minutes from the McDonnel-Douglas computer makes it possible to machine unavailable ship parts to meet urgent repair schedules.

The Shipyard provides an apprentice training program with approximately 400 personnel participating in this training for twenty-one different trades each year to meet the objective of maintaining basic skills. As part of the career development program implemented by this Shipyard, more than 600 personnel attend classes in the training department after working hours to increase their skill knowledge and acquire college credits.

Since Pollution and Environmental Control is a high priority item today, this Shipyard has established a permanent Environmental Improvement Program for protecting environment and for maintaining high quality industrial safety standards. The Environmental Improvement Committee meets regularly to study potentially offending processes and determine necessary controls. As a part of the Shipyard's continuing program of environmental improvement, the Engineering Division and Service Group have been conducting evaluative tests on hydro-blast equipment as a substitute for open air sandblasting in drydocks. Another such improvement is the use of Bricksaws with dust collectors attached to stop dust pollution in cutting firebrick

To meet the critical need to improve waterfront capabilities and facilities and to provide sufficient flexibility to meet workload changes and technological advances required for fleet support, this Shipyard has completed Modernization and Military Construction Projects costing approximately 7 million dollars since 1968. These projects include, in part, Pier 6 Utilities, Service Building Pier E, 1st Increment of Electronic Weapons Precision facility and several environmental control projects. Currently approximately 20 million dollars in construction is underway.

The Long Beach Naval Shipyard enjoys an excellent reputation among its fleet customers. The past and current performance in terms of producing timely, economical and quality work coupled with a zeal in responsiveness contributes to this reputation.

The workload of this Shipyard consists largely of overhaul and maintenance of surface ships. The yard is capable of completely overhauling all non-nuclear surface ships in the Navy. During fiscal year 1972 this Shipyard repaired 148 ships.

FACTS FOR FISCAL YEAR 1972

Work Force			
Military	46		
Civilian	6,397		
Workload		**Mandays**	**No. of Ships**
Regular Overhauls		913,000	22
Restricted & Techn. Avbltys.		82,000	101
Miscellaneous Shipwork		39,000	25
Other Production Work		125,000	
Type of Ships			
Carriers		0	
Cruisers		0	
Destroyers		33	
Amphibious War Fare		33	
Mine War Fare		15	
Patrol & Ocean Escorts		32	
Auxiliary		33	
Other		2	
Total		148	
Volume of Business			
Materials & Services		$36,278,000	
Salaries & Wages		92,065,000	
Total		$128,341,000	

MT-PWHD-005784

PRODUCED 1983

LONG BEACH NAVAL SHIPYARD

MISSION

The official mission of the Long Beach Naval Shipyard is "To provide logistic support for assigned ships and service craft; to perform authorized work in connection with construction, conversion, repair, alteration, dry-docking, and outfitting of ships and craft as assigned; to perform manufacturing, research, development, and test work, as assigned; and to provide services and material to other activities and units, as directed by competent authority."

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JM - 83