

NAVSHIPS 900,000.101

NON-REGISTERED

**ELECTRONICS
INSTALLATION
AND
MAINTENANCE
BOOK**

**INSTALLATION
STANDARDS**

**DEPARTMENT OF THE NAVY
BUREAU OF SHIPS**

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ORIGINAL

PREFACE

The Installation Standards Handbook provides the latest proven techniques for the installation of electronics equipment on shipboard. It standardizes installation practices and techniques. The Handbook has been arranged as nearly as possible in chronological order of installation events starting with the receipt of equipment from source of supply, and proceeding to standard installation practices preliminary to placing the equipment into service.

The Electronic Installation and Maintenance Book (EIMB), NAVSHIPS 900,000 series, provides subordinate policies, installation and maintenance standards for Naval electronic equipment.

The EIMB is being expanded and is organized and issued as separate handbooks, each handbook being a separate item of supply with its own NAVSHIPS decimal number, as follows:

NAVSHIPS	HANDBOOK TITLES
900,000.1	Communications
900,000.2	Radar
900,000.3	Sonar
900,000.4	Test Equipment
900,000.5	Radiac
900,000.7	Countermeasures
900,000.100	General
900,000.101	Installation Standards
900,000.102	Electronic Circuits
900,000.103	Test Methods and Practices
900,000.104	Reference Data
900,000.105	RF Interference Reduction

For information concerning Classified Material, refer to NAVSHIPS 900,000.100.

The Installation Standards Handbook, NAVSHIPS 900,000.101, is in effect upon receipt and replaces all previous data of corresponding nature in the EIMB.

Suggestions for additions and corrections of errors should be submitted to BuShips Electronics Division, Fleet Electronics Effectiveness Branch (Code 678), Bureau of Ships. Periodic revisions and additions will be made to insure that the material will always reflect the best current techniques and keep abreast of new developments.

Requisitions for additional copies of this handbook should be submitted to Naval Supply Depot, Philadelphia, Pennsylvania. Activities not already on the distribution list for the EIMB should submit requisitions to Chief, Bureau of Ships (Code 679A2), in order to insure receipt of future revisions.

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	CHANGES MADE	SIGNATURE

INSTALLATION STANDARDS

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*This subsection is published prior to complete fleet and field review in order to make the material available at the earliest possible time. Personnel concerned with installation of electronic equipment are urged to make comments and recommendations in accordance with Section 1. Comments received will be considered during next revision of the subsection.

**To be issued in later changes.

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**To be issued in later changes.

1-1. POLICY.

a. The Bureau of Ships Manual Chapter 67 states that Installation and Maintenance Standards will be established in order to attain and maintain the best possible condition of operation and material readiness of electronic equipment.

b. Such standards are in the form of published instructions illustrated as necessary, incorporating the latest proven techniques for installation and maintenance which will provide for optimum equipment performance.

1-2. DOCUMENTATION.—The information contained in this chapter has been gleaned from numerous publications, instructions and pamphlets obtained from Military and Commercial sources. It represents the best current knowledge in the electronic installation and maintenance field.

1-3. OBJECTIVE.—The satisfactory performance of present day electronic equipment depends to a great extent on the techniques employed in the original installation. It further depends upon the skillful application of these techniques by the Installation Technician and upon the quality of the Installation materials used. Continued satisfactory performance is dependent upon the work done by the men who inspect, repair and maintain the system. The objectives of Installation Standards are to aid in this field by:

a. The preparation and assembly in one main section or chapter, the approved practices and techniques to be employed in the installation, repair and maintenance of all electronic equipment.

b. The standardization of these practices and techniques which, when used, will provide uniform and satisfactory electronic installations.

c. The indoctrination of all personnel involved in the field of electronic installation and maintenance with the importance of good workmanship.

d. To make all personnel involved in the field of electronic installation and maintenance aware of the equipment and material failures which may result from poor workmanship.

e. The promotion of personnel safety by pointing out and prohibiting unsafe installation and maintenance practices.

1-4. COMPILATION OF MATERIAL.—The material compiled in this chapter has been arranged as nearly as possible in chronological order relative to an actual electronic installation job which is begun by receipt of the equipment from the sources of supply and follows through to the completion of the system installation.

a. Each main section, as listed in the table of contents on page 1, covers a separate phase of the installation procedure.

b. The material contained within each main section is sub-divided into specific methods and techniques which are listed in a table of contents at the beginning of each main section.

c. Each specific method or technique is furnished with a table of contents as the first sheet.

d. Each main section is started with a sub-section containing general information, reference documents and definitions covering material contained within that particular section.

1-5. CORRECTIONS.—Recommendations for correction of errors, should be reported to the Electronics Division, Fleet Electronics Effectiveness Branch (Code 678), Bureau of Ships and include the following:

a. Location of error by sub-section, page and line.

b. Description of error and indication of what change should be made.

1-6. ADDITIONS.—Recommendations for the inclusion of additional information should be reported to the Electronics Division, Fleet Electronics Effectiveness Branch (Code 678), Bureau of Ships and include the following:

a. A complete description of the addition, including illustrations and tabular data desired.

b. Indication of recommended location of the addition by sub-section and page numbers.

1-7. REVISIONS.—Periodic revisions and additions will be made to insure that the material in this handbook will always reflect the best current techniques, and keep abreast of new developments in the field.

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2-1. GENERAL.

a. **PURPOSE.**-Improper handling of electronic equipment can cause serious damage to delicate instruments and components used to make up the equipment units. The purpose of this section is to provide handling instructions which, if properly followed, will greatly reduce equipment damage.

b. **SCOPE.** - The material contained in this section will identify the crated equipment, give instructions for correct and safe methods of unpacking, and show safe methods of carrying and hoisting the equipment.

c. **REFERENCE DOCUMENTS.** -

(1) ESO Publication # 10 (Apr 1960)

(2) Phase I - Joint Mil. Packing Course "Preservation and Intermediate Protection"

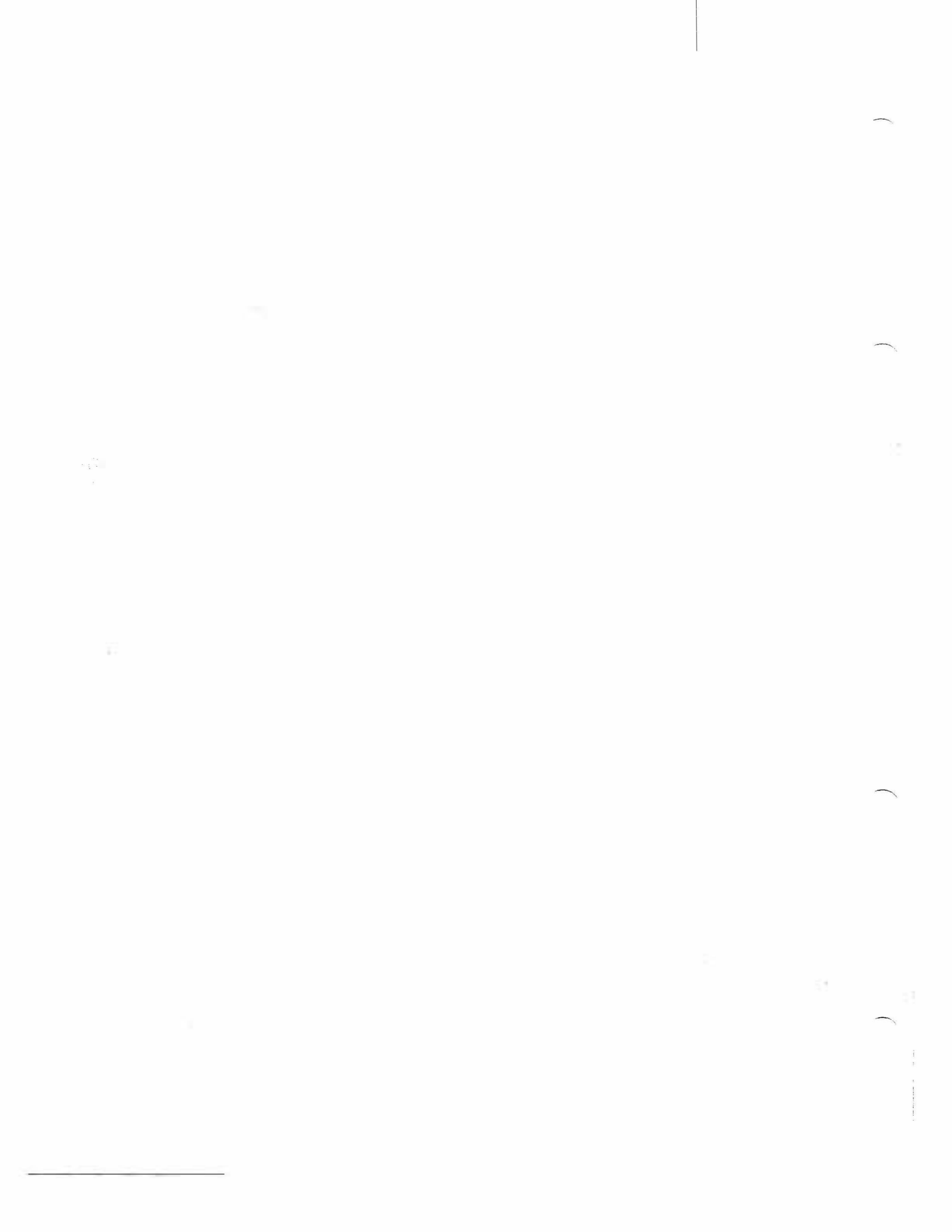
(3) Phase II - Joint Mil. Packing Course "Packing, Crating and Carloading"

(4) NAEXOS P-938 "Preservation, Packaging and Packing of Military Supplies and Equipment"

(5) MIL-STD-129B Mil. Std. Marking, Shipping and Storage

(6) BUREAU OF SHIPS MANUAL Chapter 67

d. **DEFINITIONS.** - None.



2-2. CRATE MARKING.-Crates or boxes containing electronic equipment are identified and marked for handling as follows:

a. SERVICE SYMBOLS. - Containers can be identified as to service department by the markings shown in figure 2-1.

b. SERVICE COLORS. -Crates or boxes containing electronic equipment may be identified as to service department by the appropriate color marking on the container. These colors are as follows:

- (1) NAVYGreen
- (2) MARINE CORPSOrange
- (3) AIR FORCEBlue
- (4) ARMYOrange

c. OPENING SIDE. - Crates or boxes are marked with the words "FRONT" or "OPEN SIDE", as appropriate, in order to permit unpacking without damage or waste of time.

d. SETS OF BOXES. - When more than one box is necessary to pack the complete equipment, the boxes will be identified by a sequence of numbers which represent the sequence in which the boxes should be opened to permit orderly assembly of the equipment.

e. NAVY ELECTRONIC MARKING SYMBOLS. - Special symbols identifying different types of Navy electronic equipment are shown in figure 2-2.

f. FRAGILE ITEMS. - If the box is holding a fragile item, it will be marked in at least three places with a red fractured disc with the word "FRAGILE" imposed in white (see figure 2-3a).

g. TOP MARKING. - If boxes are to be stowed or stacked with one particular side "up", this side shall be marked "THIS SIDE UP" or "TOP". In addition, the sides will be marked in two places with an arrow pointing toward the top of the box and the word "UP" immediately above the arrow.

h. BATTERIES. - When equipment contains a battery, the type of battery will be plainly marked directly under the description of contents as shown below:

- (1) WET BATTERY CHARGED
- (2) UNFILLED BATTERY-NOT CHARGED
- (3) UNFILLED BATTERY -CHARGED
- (4) DRY CELL BATTERY

i. ELECTROLYTE. -Boxes containing electrolyte will be conspicuously marked with the words "CONTAINS ELECTROLYTE CORROSIVE LIQUID PACKED ACCORDING TO DOD REGULATIONS".

j. CENTER OF BALANCE AND SLING POINTS. - A 1/2 inch wide vertical line locating the center of balance will be painted on the bottom edge of both sides of box over 10 feet in length or those which are unbalanced and the same shall be identified by the words "CENTER OF BALANCE".

On unboxed or mobile equipment, the location of sling points will be marked in red and identified by the words "SLING POINTS".






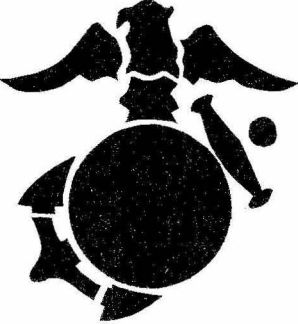
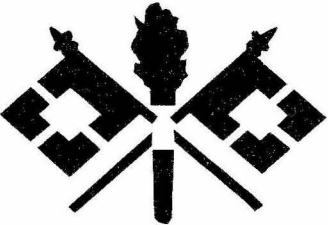
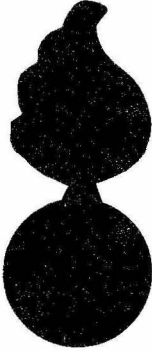
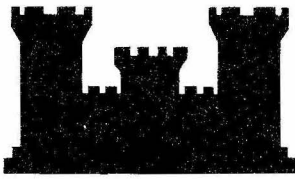
 <p>BUREAU OF AERONAUTICS</p>	 <p>BUREAU OF ORDNANCE</p>	 <p>BUREAU OF YARDS AND DOCKS</p>
 <p>BUREAU OF SHIPS</p>	 <p>COAST GUARD</p>	 <p>MARINE CORPS</p>
 <p>SIGNAL CORPS</p>	 <p>ORDNANCE CORPS</p>	 <p>CORPS OF ENGINEERS</p>

Figure 2-1. Service Symbols.

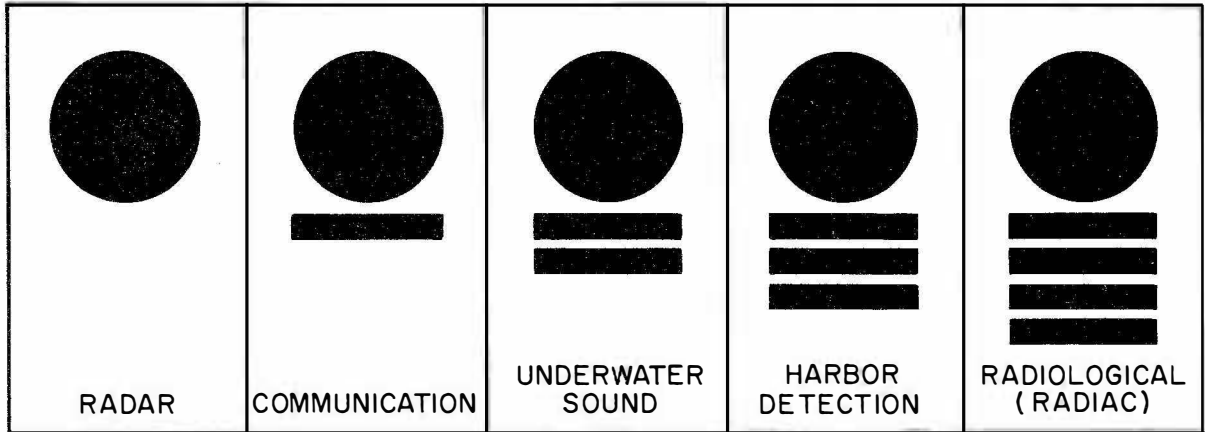


Figure 2-2. Navy Electronic Marking Symbols.

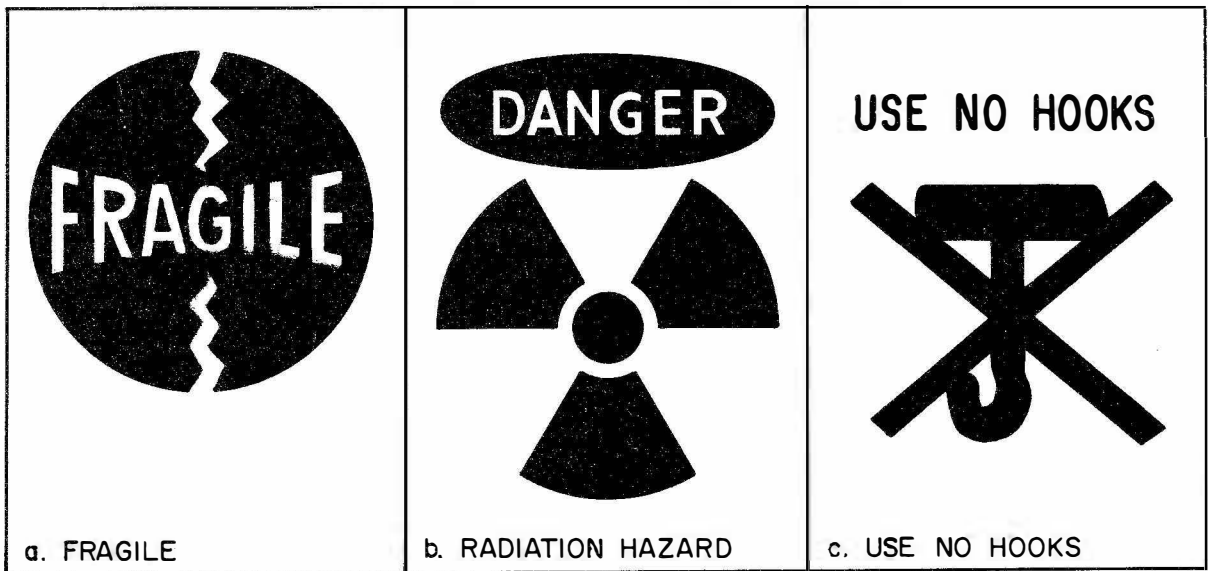


Figure 2-3. Caution Markings.

k. **MAGNETIC MATERIALS.—**

(1) **SUITABLE FOR AIR SHIPMENT.—** Boxes and packages containing magnets, magnetron magnets and magnetron tubes will be conspicuously marked on two opposite sides with a red "caution" label and white lettering as shown below:

MAGNETIC EQUIPMENT
CAUTION
SUITABLE FOR AIR SHIPMENT IF MAINTAINED
A DISTANCE OF SEVEN (7) FEET OR MORE FROM
COMPASS SENSING DEVICES

(2) **NOT SUITABLE FOR AIR SHIPMENT.—** Boxes and packages containing magnets, magnetron magnets and magnetron tubes will be conspicuously marked on two opposite sides with a red "caution" label and white lettering as shown below:

CAUTION
NOT FOR AIR SHIPMENT
THIS PACKAGE CONTAINS
MAGNETIC EQUIPMENT
DO NOT STORE OR PARK WITHIN FIFTY FEET
OF PARKED AIRCRAFT OR CARGO WHICH MAY
BE AFFECTED

l. **RADIATION HAZARD.—** Boxes containing radioactive materials will be marked with the radiation hazard label as shown in figure 2-3b.

m. **USE NO HOOKS.—** Boxes which could be damaged by the use of hooks will be marked by the hook symbol with a superimposed X and the legend "USE NO HOOKS" as shown in figure 2-3c.

n. **ABBREVIATIONS.—** Box marking abbreviations used for package units, quantitative units, weight and measurement units and miscellaneous are given in table 2-1 through 2-4.

o. **BASIC MARKING.—** A plan view of a carton containing a piece of communication equipment is shown in figure 2-4, on page 2-2-5.

FROM _____
CONTRACT No. _____
B/L No. _____
TO: _____

(TOP)

FIIN _____
AN/NOMENCLATURE _____
DATE PACKED _____
WT. _____ LBS. _____
QTY _____
SER. No. _____
CUBAGE _____
METHOD OF PRESERVATION _____

UP

FIIN _____
AN/NOMENCLATURE _____
DATE PACKED _____
WT. _____ LBS. _____
QTY _____
SER. No. _____
CUBAGE _____
METHOD OF PRESERVATION _____

UP

CENTER OF BALANCE

Figure 2-4. Basic Marking.

TABLE 2-1. PACKAGE UNIT ABBREVIATIONS.

MEANING	ABBREVIATION	MEANING	ABBREVIATION
Ball	BA	Hank	HK
Barrel	BBL	Length	LG
Book	BK	Package	PKG
Bottle	BT	Pallet	PL
Bundle	BDL	Paper	PA
Cake	CK	Piece	PC
Carton	CTN	Reel	RE
Case	CS	Ribbon	RI
Chest	CHT	Roll	RL
Coil	CL	Sheet	SH
Cone	CE	Skid box	SB
Crate	CRT	Sleeve	SL
Deck	DK	Spool	SP
Drum	DR	Stick	ST
Envelope	ENV	Tube	TU
Flask	FLK	Unit	UN

TABLE 2-2. QUANTATIVE UNIT ABBREVIATIONS.

MEANING	ABBREVIATION	MEANING	ABBREVIATION
Dozen	DOZ	Quire	QR
Each	EA	Ream	RM
Gross	GR	Round	RD
Hundred	C	Thousand	M
Pair	PR	Great Gross	GG

TABLE 2-3. WEIGHT AND MEASURE UNIT ABBREVIATIONS.

MEANING	ABBREVIATION	MEANING	ABBREVIATION
Bushel	BU	Ounce	OZ
Centigrade	C	Pint	PT
Centimeter	CM	Pennyweight	DWT
Cord	CD	Pound(s)	LB(S)
Cubic centimeter	CC	Quart	QT
Cubic foot	CU	Square foot	SQF
Dram	DM	Square yard	SQY
Foot	FT	Net long ton	TLN
Gallon	GAL	Net short ton	TSN
Grain	GR	Long ton	TLG
Hundredweight	CWT	Gross short ton	TSG
Inch	IN	Volume	VOL
Linear feet	LNF	Weight	WT
Linear yard	LNY	Yard	YD
Milliampere	MA		

TABLE 2-4. MISCELLANEOUS ABBREVIATIONS.

MEANING	ABBREVIATION
Advance base construction depot	ABDC
Advance base depot	ABD
Advance base section	ABS
Aviation supply annex	ASA
Basic boxed base load	BBB
Bill of lading	B/L
Central Torpedo Office	CTO
Chemical Corps	CMLC
Combat serviceable	CS
Contract	CONT
Contractor	CONTR
Corps of Engineers	CE
Dimensions	DIM
Engine	ENG
Federal Stock Number	FSN
Government bill of lading	GB/L
Invoice	INV
Less than carload	LCL
Manufactured	MFD
Marine Corps Depot of Supplies	MCDS
Marine Corps Supply Depot	MCS
Marine Corps Forwarding Depot	MCFD
Mark	MK
Medical Corps	MC
Moisture Fungus-Proofed	MFP
Naval Aviation Supply Depot	NASD
Naval Ammunition and Net Depot	NA&ND
Naval Ammunition Depot	NAD
Naval Degaussing Station	NDS
Naval Gun Factory	NGF
Naval Magazine	NM
Naval Mine Depot	NMD
Naval Ordnance Plant	NOP
Naval Ordnance Test Station	NOTS
Naval Powder Factory	NPF
Naval Supply Center	NSC
Naval Supply Depot	NSD
Naval Torpedo Station	NTS
Net weight	NETWT
Ocean bill of lading	OB/L
Officer	OFF

TABLE 2-4. MISCELLANEOUS ABBREVIATIONS (CON).

MEANING	ABBREVIATION
Ordnance Corps	ORD
Ordnance Supply Depot	OSD
Ordnance Stock Office	OSO
Packed	PKD
Port Transportation Officer	PTO
Quantity	QTY
Quartermaster Corps	QMC
Requisition	REQ
Signal Corps	SigC
Shipment order	SO
Standard Navy Stock Number	SNSN
Tare weight	T/WT
Transportation Corps	TC
Transportation Officer	TO
U.S. Coast Guard	USCG
U.S. Marine Corps	USMC
United States Pharmacopoeia	USP
United States ship	USS

2-3. UNCRATING.—Electronic equipment is very carefully packed in crates and boxes to avoid any damage during transit. If the crates or boxes are carelessly opened or handled after receipt of the equipment, serious damage may result.

a. **UNPACKAGING SEQUENCE.**—If an equipment consists of several boxes, all the boxes should be assembled according to the box numbers and the units unpackaged in sequence. These box numbers were marked on packaging so that they represent the sequence in which the boxes should be opened to permit orderly assembly of the equipment.

b. **CRATE HANDLING.**—Crates should be handled with the same care given to any delicate apparatus. Equipment should be uncrated in an area where a hoist is available to lift the units from the cases. If no hoist is available, the area used for uncrating should be large enough to permit sufficient personnel to handle the equipment and to lift it easily and safely from the crate. The crates should be kept upright as indicated by the arrows.

CAUTION

Crates should never be pushed or rolled, and to insure against improper handling, electronic personnel should be present at the unpacking of equipment. Most yards have a regulation to this effect.

c. **STRAP BAND AND NAIL REMOVAL.**—Straps and bands should be removed from the crates with a pair of snips. The nails should be removed from at least three sides of the crates with a nail puller. (SNSN G-41-P-4950). (DO NOT USE A HAMMER OR PINCH BAR TO REMOVE NAILS FROM THE CRATE. NEVER POUND THE PACKING CASE.) When the sides of the crates have been removed, the moisture-proof paper should be taken off the equipment. The equipment is then lifted from its case and inspected for any damage that may have occurred during transit.

d. **INVENTORIES.**—A complete inventory of all parts should also be made at this time. As parts are checked, they should be marked off on the packing list. Report any missing or damaged parts to the proper authorities.

e. **STORAGE.**—If the equipment is stored in the electronics shop, it should be covered with a canvas cloth to protect it from dust or dirt. Wooden or sheet metal forms may be used to keep it from getting damaged. If any forms are packed around controls or instruments, they should be left in place until the units are installed.

f. **SALVAGE.**—Special shipping forms, as well as the sides of wooden crates in which an equipment is shipped, should be returned to the supply department after the equipment is unpacked. Cardboard cartons may also be salvageable and should be sent to the shop having charge of salvage.

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2-4. CARRYING.—Electronic equipment must be protected against damage due to undue force or exposure while in transit as any damage will reduce the useful life span of the equipment or will cause the equipment to be damaged beyond repair.

a. **FORCES.**—Damage may result from hazardous forces encountered in transportation or handling.

(1) **TRANSPORTATION.**—Hazardous forces encountered in transportation would result in damage caused by abrupt starts or stops and vibration or jolting.

(2) **HANDLING.**—Hazardous forces and resultant damage encountered in handling during loading, unloading or transit operations are:

(a) **MANUAL HANDLING.**—Dropping and puncture.

(b) **FORKLIFT TRUCK HANDLING.**—Dropping and puncture.

(c) **CARGO NETS.**—Dropping, crushing and wracking.

(d) **GRAB HOOKS.**—Crushing and puncture.

(e) **SLINGS.**—Crushing, dropping and wracking.

(f) **CONVEYORS.**—Jarring, smashing and dropping.

b. **EXPOSURE.**—Exposure to the different climatic conditions and weather hazards such as high humidity, rain, salt spray, extreme cold, dry intense heat, and the cycling of these weather conditions will tend to accelerate the breakdown or deterioration of unprotected equipment. Protection from these conditions shall be furnished by the use of proper protective materials while the equipment is in transit.

c. **CUSHIONING.**—The use of cushioning materials will provide protection from physical and mechanical damage. Resilient or elastic materials will absorb energy caused by shock and vibration from external sources. The more important functions of cushioning are:

(1) **IMPACT SHOCK ABSORPTION.**—The shock energy is absorbed as the cushioning material is compressed. The extent of absorbing shocks will depend upon the degree of compressibility of the cushioning material and the thickness in which it is used.

(2) **FORCE DISTRIBUTION.**—The damaging forces are distributed over a larger area, thus reducing the energy concentration at any one point on the surface of the equipment.

(3) **MOVEMENT AND VIBRATION LIMITATION.**—Cushioning, when properly used, limits free movement of the equipment and tends to dampen vibrations due to external forces.

(4) **SURFACE ABRASION PREVENTION.**—Proper use of cushioning will prevent abrasion or other damage to the external finished surfaces of the equipment.

d. **PRECAUTIONS.**—When moving the equipment onto the truck, care should be taken to prevent damage to the equipment and injury to personnel. Weight alone is not an indication that the service of a rigger is required. Size also must be taken into consideration. It is evident that a light and large and bulky equipment cannot easily be handled by one man. A weight of 50 pounds for one man, or 100 pounds for two men is usually considered as a safe limit for carrying. When lifting a piece of equipment, bend the knees, keep the back straight and lift with the legs. Lifting in this manner will prevent back strain.

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2-5. HOISTING.—Hoisting of electronic equipment should be done by qualified riggers under the supervision of electronic engineers.

a. **RIGGING.**—At the ship, riggers should prepare the unit for hoisting while it is still aboard the truck.

(1) **SLING INSTALLATION.**—The eye-bolts alone should not be used for hoisting purposes. Slings, preferably comprised of wire rope, should be taken under and around the equipment to prevent pulling out at the eye-bolts and to prevent tipping while the equipment is being hoisted. A "back" or protective lashing should be taken on the equipment to prevent it from slipping. A "tag" or steadying line should be taken on the equipment to move it while it is out of reach. See figure 5-1 for a typical sling arrangement.

(2) **PROTECTION FROM SLINGS.**—Where slings fit against the equipment they should be covered with leather, canvas or rubber hose. Any special devices available should be used for hoisting. Where finely machined surfaces are encountered, zinc strips, lead-lined clamps, or clean manila line should be used.

(3) **SPREADERS.**—Spreaders should be used on the slings where practicable. Spreaders are used to prevent the lashings from pressing against the equipment caused by the strain of lifting.

(4) **MOUSING.**—The shackle or eyesplice should be secured to the hook of the hoist and the hook "moused". "Mousing" the hook consists of tying off the open end with a few turns of marlin or line.

b. **EQUIPMENT TRANSFER.**—The equipment may now be hoisted from the truck and onto the ship. The equipment should be hoisted as close as possible to its final destination. When a hatchway or compartment prevents further movement of the equipment in this manner, chain falls and dollies should be used.

(1) **CHAIN FALLS.**—A chain fall can be used in moving equipment through a hatchway, or a series of them can be used to move equipment through a compartment by passing it from one fall to another.

(2) **DOLLIES.**—Dollies are especially useful in rolling a piece of equipment through a compartment. Proper care should be exercised to prevent the equipment from being jarred or bumped. The equipment should be lowered to its foundation with the utmost care to insure its proper positioning. A chain fall hung over the foundation is very useful for this purpose. Shims and washers may be used to level the equipment.

c. **SCAFFOLDING.**—If the equipment is to be hoisted to the mast, a safe working platform or scaffold should be in place before the hoisting is done. Large antennas should be rigged about the base as well as from their hook eyes. Rubber hose should be used to prevent the slings from damaging any part of the antenna. Men working on a mast should observe all safety precautions as listed on Chapter 67 of the Bureau of Ships Manual.

NOTE

Where scaffolds are used, steel ones are preferred to wooden ones as they are secured easier, stay together longer, are safer, and much less bulky than wooden ones.

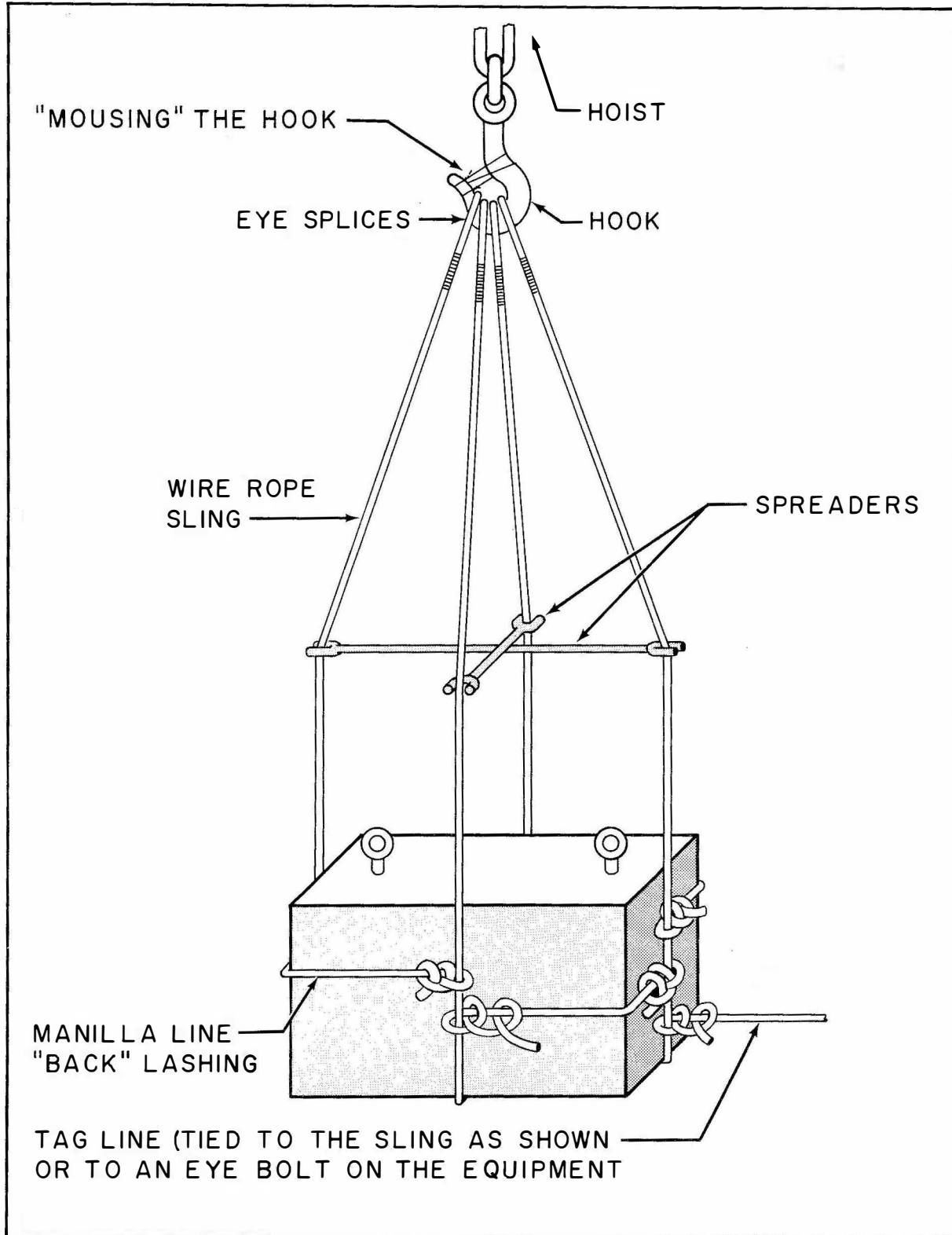


FIG. 2-5-1 TYPICAL SLING ARRANGEMENT.