CHAPTER 1

UNDERWATER MINE MAINTENANCE SYSTEM

LEARNING OBJECTIVES

Upon completing this chapter, you should be able to do the following:

1. Identify the different levels of mine maintenance and maintenance schedules.

2. Describe the requirements for the recording and reporting of the maintenance on mines and associated equipment.

3. Recognize the types and causes of corrosion and the common types of materials available for use in corrosion prevention and protection against moisture.

4. Identify the proper shop procedures in torquing, power tool usage, maintenance of power tools, and mine assembly equipment.

The Underwater Mine Maintenance System is designed to ensure that all mine weapons systems are reliable and ready for issue. The system is used to prevent equipment failures that might otherwise result in repeated corrective maintenance actions.

As a Mineman, whether a supervisor or a worker assigned to the mine assembly division, you will encounter diferent levels of maintenance. This chapter defines each level as it applies to underwater mines and destructors and indicates the action assigned to each level. It also provides the rationale for the assignment of such actions.

Topics in this chapter include mine maintenance levels, recording and reporting maintenance, corrosion control, and shop procedures.

MINE MAINTENANCE LEVELS

The Underwater Mine Maintenance System is organized under the standard Department of Defense Maintenance System and contains three levels. All maintenance actions are to be performed under one of these levels.

Because of the many tasks associated with the corrective maintenance of mines and associated equipment, you should refer to *Underwater Mine Maintenance System,* NAVSEA SW550-FO-PMS-010; appropriate mine assembly manuals; and assembly-level items, class-B criteria manuals for additional information.

This section discusses organizational-level maintenance, depot-level maintenance, interrnediate-level maintenance, programmed maintenance, and other maintenance cycles.

ORGANIZATIONAL-LEVEL MAINTENANCE

Organizational-level maintenance is the lowest level of maintenance. Performed by the user organization on its assigned equipment, it consists of inspecting, servicing, lubricating, adjusting, and replacing parts, minor assemblies, and subassemblies.

Once the weapons have been delivered to the planting vehicle and regardless of who performs the task, the following actions are organizational-level maintenance functions:

- Visual inspections
- Flight gear reorientation
- Safety device removal (safety pins, lanyards, etc.)

Mines in the custody of the using organizations are relatively maintenance free. Whether on board ships or stations for specific minefield planning missions or for contingency purposes, mines are off-loaded if the mission is aborted or if programmed maintenance is required. As an exception, actions to change a mine's short-cycle maintenance period, in lieu of off-loading and performing programmed maintenance, are permitted when operational or tactical situations dictate. These actions must be approved by the operational commander in accordance with chapter 3 of NAVSEA SW550-FO-PMS-010 and must be performed by Mobile Mine Assembly Group (MOMAG) personnel.

The organizational-level function of delivering surface- or submarine-laid mines pierside for shipment in assembly configuration A is peformed by shore-based activities. These mines normally do not require further assembly or maintenance, other than visual inspections, by personnel assigned to the using organization. The mines remain on board only for the duration of a specific mission and are returned ashore for programmed maintenance if the mission is aborted or canceled.

Aircraft-laid mines are delivered to air stations for planting by shore-based aircraft and are returned to an intermediate-level mine assembly activity if the mission is aborted. For planting by carrier-based aircraft, mines delivered on board maybe accompanied by detachments of MOMAG teams. These teams, when required by operational commanders, are equipped to complete final preparations or make operational setting changes to the mines before their release to carrier personnel, who then load the mines on aircraft. Again, such consignments are normally for the duration of a specfic mining mission only, the mines require no maintenance for that duration except visual inspection. The mines are returned to an intermediate-level maintenance site if the mission is aborted or when programmed maintenance is required.

DEPOT-LEVEL MAINTENANCE

Depot-level maintenance of mines includes the support of intermediate-level maintenance activities. Depots have more extensive industrial facilities and equipment than are available at intermediate-level activities.

Supported by technical repair standards (TRSs) and overhaul, screening, and repair specifications (OSRS) documents, the following actions are depot-level maintenance functions with regard to assembly-level items, test equipment, and support equipment: repair, alteration, modification, modernization, overhaul, reclamation, and reconstruction.

Depot-level maintenances performed only at specific shore-based military or contracting facilities. Although depot-level maintenance, as applied to mine weapons systems, consists of component maintenance, intermediate-level functions that are performed ashore may be performed at depots. When that is done, the functions remain intermediate-ievel functions; that is, intermediate-level maintenance on depot-stored assembled mines may be performed at naval weapons stations.

A depot may have MOMAG teams assigned in support of operational requirements. In that case, intermediate-level mine maintenance remains intermediate, regardless of where it is performed.

INTERMEDIATE-LEVEL MAINTENANCE

Intermediate-level maintenance is performed by MOMAG activities responsible for providing direct-and general-support mine maintenance to using organizations. To the extent authorized by proper authority, the following actions are intermediate-level maintenance functions:

- Assembly, disassembly, maintenance, and testing of mines

- Testing replacement, adjustment, alteration and minor repair of assembly-level items

- Field calibration, adjustment, and repair of special-purpose test equipment and tools

- Preservation

- Inspection

- Emergency fabrication of nonavailable parts when so directed

- Provision of technical assistance to using organization

Although assembled mines are not repaired at any maintenance level, they are subject to intermediate-level programmed maintenance in which malfunctioning or worn assembly-level items may be adjusted, refurbished, or replaced by spares. In the course of such maintenance, piece parts that are subject to loss, damage, or wear may be replaced when they are listed in an activity's mine bills of material (MBOMs). Replacing such items is considered minor repair.

PROGRAMMED MAINTENANCE

Programmed maintenance is a systematic means by which mines are maintained in a ready-for-issue (RFI) status. This is accomplished by applying class-B criteria, peforming class-C testing, replacing malfuctioning components, performing visual inspections, and preventing the deteriorative effects of rust and corrosion.

Required readiness, and thus the maintenance effort, depends on the location of weapons and their intended uses. Maintenance functions must be planned and performed in such away to ensure a state of readiness that satisfies planned weapons usage.

This section describes how the Underwater Mine Maintenance System applies to service mines in various configurations and to mine assembly-level items and explains the maintenance program for such mines and items.

NOTE: Because programmed maintenance intervals change, refer to NAVSEA SW550-FO-PMS-010 for changes in maintenance intervals for mines, subassemblies, and assembly-level items.

Mines are stowed in one of six authorized degrees of assembly configurations: A, B, C, D, E, and F. These assembly configurations allow completely or partially assembled and tested mines to be assembled and/or issued to a mine-planting agent within the minimum amount of time specified by operational commanders. Operational commanders designate the configurations in which activities will maintain their mines, taking into consideration operational requirements, facilities, and personnel available at the activities.

To maintain mines in an RFI status, programmed maintenance must be performed. Programmed maintenance for mines is divided into two types (short cycle and long cycle) and consists of visual inspection, item replacement, component substitution, class-B criteria, and/or class-C testing.

Short-Cycle Maintenance

Short-cycle maintenance must be performed periodically on mines stored in assembly configurations A, B, and C to confirm their operability. Under certain conditions, short-cycle maintenance may be required more frequently than is specified in NAVSEA SW550-FO-PMS-010. Normally, a maintenance period is short-cycled because of battery-life limitations, In that event, short-cycle maintenance is performed before the mine's battery life expires. Short-cycle maintenance should not be prolonged if the life of the battery has expired.

Mine assembly manuals outline short-cycle maintenance requirements and provide maintenance procedures for each specific mine. Generally, short-cycle maintenance consists of the following functions:

- Disassembly of the mine to the point where the instrument rack and the Safety Device and Arming Group (S&A) are removed and the electrical connections are accessible to perform the system tests.

- Performance of the instrument rack subassembly, the anchor, and the system (class-B) tests.

- Replacement of the defective assembly-level items.

- Subjection of the S&A group to class-B criteria.

- Removal of the tail section and the target detection device (TDD) subassembly from the mine case.

- Verification of the mine's battery life and replacement of batteries that will not support another short-cycle maintenance period.

- Restoration of the mine case, the mechanism section, the anchor, the explosive section, the tail section, and the skids or crates.

- Performance of the instrument rack subassembly, the anchor subassembly, and the system tests, when appropriate, if any assembly-level items are replaced.

- Reassembly of the mine to its assigned assembly configuration.

- Performance of the assembled mine (class-C) tests.

- Submission of the appropriate maintenance reports.

Assembly-level items that are used as replacements during short-cycle maintenance must have a programmed maintenance schedule (PMS) date that is the same or later than the due date of the mine in which the items are being installed. The reason for this requirement is that the mine's PMS date must be changed to that of the replacement item if an assembly-level item's PMS is due before the mine's PMS (long-cycle) date.

When the urgency of the situation dictates, operational commanders may extend the short-cycle maintenance period for mines afloat. However, three factors must be considered in this extension:

1. The expected life of the mine

2. The resistor plug installed in the sterilizer

3. The storage time of the batteries

To calculate the extended storage time for a mine, apply these factors to the following formula:

$$(X-Y) \div Z = \text{Extended storage time}$$

X = Expected life (in months) of the mine

Y = Value (in months) of the resistor plug installed in the mine

Z = Effective storage time of the mine batteries

NOTE: If the result is less than 1, no extended time is allowed.

Long-Cycle Maintenance

Long-cycle maintenance is performed to confirm the operability of designated assembly-level items installed in mines stored in assembly configurations A, B, C, D, and E. This maintenance must be performed periodically in accordance with table 3-2 of NAVSEA SW550-FO-PMS-010. These items are listed in *Mine Components A through C Description and Class-B Criteria,* NAVSEA SW550-AA-MMI-010.

Maintenance Extensions

A 10-percent random sample of explosive sections of Mine Mk 56 assembled to configurations D and E need only be subjected to class-B criteria every 6 years. However, if the 10-percent sample contains a reject, the lot from which the reject was taken must be subjected to 100-percent inspection. On the other hand if all items in the sample meet the inspection criteria, the maintenance cycle can be extended for 6 additional years. These items are identified in the maintenance tables of NAVSEA SW550-AA-MMI-010.

Assembly-Level Items

An assembly-level item is a component that consists of one or more parts that are designed to function as an end item in a mine assembly.

Class-B criteria must be performed on assembly-level items. Visual inspections, parts inventories, and fictional tests are all considered class-B criteria. The required intervals for these criteria are detailed in NAVSEA SW550-FO-PMS-010. At such times, however, whether the job sheet for an assembly-level item contains only one, two, or all three of the criteria, it must be verified that such items meet the job sheet specifications if they are to be accepted into service use.

Two specific terms are applicable to the performance of these criteria:

- *Functional test:* The technician uses test instruments to verify specific operating characteristics,
- *Visual inspection:* Testing is performed by sight, feel, or manipulation, without the use of the test instruments.

In accordance with the provisions of NAVSEA SW550-FO-PMS-010, assembly-level components are divided into four groups, commensurate with the maintenance necessary to ensure reliable operability. NAVSEA SW550-AA-MMI-010 provides a listing of all assembly-level components and assigns each to one of four groups, indicating the maintenance requirements for each.

In addition to the unique requirements for each of the four groups, receipt-inspection requirements of *Naval Ordnance Quality Assurance Procedures for Fleet Activities,* QAP 100, are applicable to items in all four groups at the time they are introduced into intermediate-level stores.

Accordingly, an assembly-level component is assigned to a particular maintenance group based on the following factors:

- Design characteristics of the component
- Function of the component
- Shelf life of the material used in its manufacture
- Service history (as determined by fleet-originated data reports)
- Frequency of the programmed maintenance cycle of the weapon in which the component is used

Assembly-level items in the four maintenance groups designed or maintained as spares must receive the same maintenance as items in assembled mines. Maintenance of spares maybe performed anytime within the specified quarter at the discretion of the commanding officer or officer-in-charge.

Except in emergency situations as discussed in mine maintenance and assembly manuals, assembly-level items must be subjected to class-B criteria before they are installed in a mine. If a mine is upgraded for increased readiness or immediate planting an assembly-level item that is within the long-cycle maintenance period may be installed in that mine without further tests. The maintenance cycle of the mine into which a tested spare has been installed does not change, and the spare component assumes the maintenance requirements of the mine.

Some assembled mines may need to be downgraded (converted to a lower configuration) or completely disassembled, and the assembly-level items repackaged and returned to stock. In either case, when such items are returned to stock they receive maintenance according to the maintenance group into which they fall. Some assembly-level items (such as arming wires, preformed packings, flat gaskets, and soluble washers that have been used on a mine) must be discarded.

NOTE: Items such as shorting clips, mine crates, and shipping containers should be retained on board for use if the mine is downgraded.

After maintenance has been accomplished, the items are repackaged in their original packing, if available. If the original packing is not available, the items are repackaged in accordance with *Handling, Packing, Storing, and Transportation of Underwater Mines and*

Destructors for Shore-Based/Shipboard Operations, NAVSEA SWO23-AB-WHS-010.

Table 1-1 categorizes the four maintenance groups and indicates the maintenance requirements for each.

MAINTENANCE REQUIREMENTS FOR GROUP 1 ITEMS.— As indicated in table 1-1, all assembly-level items in maintenance group 1 are subject to class-B criteria at long-cycle maintenance. It should be noted that many of these items listed in table 1-1 of NAVSEA SW550-FO-MMI-010 have had their long-cycle maintenance period extended to 6 years. Therefore, when IMAs are performing long-cycle maintenance, they should be aware that an extended maintenance period is appropriate to these items, but they should also be aware that a local record-keeping system is necessary to determine when the 6-year period expires. Items in maintenance group 1 are also subject to the receipt-inspection requirements of QAP 100.

MAINTENANCE REQUIREMENTS FOR GROUP 2 ITEMS.— Because of their inherent durability, group 2 items require no programmed or periodic maintenance, visual inspection or piece-parts inventory following receipt. Upon receipt of group 2 items, receipt inspection requirements of QAP 100 must be performed, and a visual inspection and piece-parts inventory must also be performed within 12 months of receipt and may be repeated periodically thereafter at the option of local commands.

MAINTENANCE REQUIREMENTS FOR GROUP 3 ITEMS.— In addition to the receipt-inspection requirements of QAP 100, group 3 items are subject to class-B criteria, as for group 1 items, but only at the time they are selected for installation in the weapon.

MAINTENANCE REQUIREMENTS FOR GROUP 4 ITEMS.— Items in group 4 need no maintenance whatsoever, except the receipt inspection requirements of QAP 100.

OTHER MAINTENANCE CYCLES

The maintenance of some mines and assembly-level items do not fall under the aforementioned maintenance levels and schedules. This section discusses Destructor Kit Mk 75 and Conversion Kit Mk 130.

Destructor Kit Mk 75

The Destructor (DST) Kit Mk 75 is used with DSTs Mk 36 and Mk 40. These kits that are on-site are subject to class-B criteria every 48 months. However, Firing Mechanism Mk 42 and Battery Mk 95 must be class-B tested within 24 months before planting. Mine shops should keep sufficient quantities of DST Kit Mk 75 in an RFI condition to meet issuing demands.

Conversion Kit Mk 130

The Conversion Kit Mk 130 is used with Mines Mk 62 and Mk 63. These kits must be subjected to class-B criteria every 60 months. This includes class-B electrical test and visual inspection of TDD Mk 57 and class-B visual inspection of Booster Mk 59 and Arming Device Mk 32.

MAINTENANCE RECORDING AND REPORTING

All programmed mine maintenance actions, with the exceptions of the calibration and repair of test equipment

Table 1-1.—Assembly-Level Item Maintenance Requirements

GROUP	MAINTENANCE REQUIREMENTS
1	Subject to class-B criteria at the time of long-cycle maintenance
2	Subject to class-B criteria in conjunction with receipt inspection
3	Subject to class-B criteria before installation/issue
4	Subject to receipt inspection only, per QAP 100

and torque wrenches and the maintenance of containers and handling equipment, are required to be reported to and evaluated by the computerized Mine Warfare Data Base at the Naval Mine Warfare Engineering Activity (NAVMINEWARENGACT).

This information is also beneficial in making engineering changes in component design which in turn, will give improved operational capability.

REPORTING FORMS

All phases of mine maintenance are covered by six report forms, five of which are supplements A, B, E, F, and J to NAVSEA SW550-FO-PMS-010. The sixth form is the Metrology Equipment Recall and Report (METER) cards.

Instructions for using these supplements are detailed on the reverse side of each form. It should be noted that whenever the instructions on the forms are at variance with the instructions contained in NAVSEA SW550-FO-PMS-010, the instructions in the NAVSEA publication take precedence.

Supplement-A Report

Supplement A, Mine System OSR Data Report, shown in figure 1-1, is used by depot-level activities to report technical repair standards (TRSs), overhaul, screening, and repair (OSR) actions, ordnance-alteration (ORDALT) actions, and mine engineering field change (MEFC) actions that are performed by work directives.

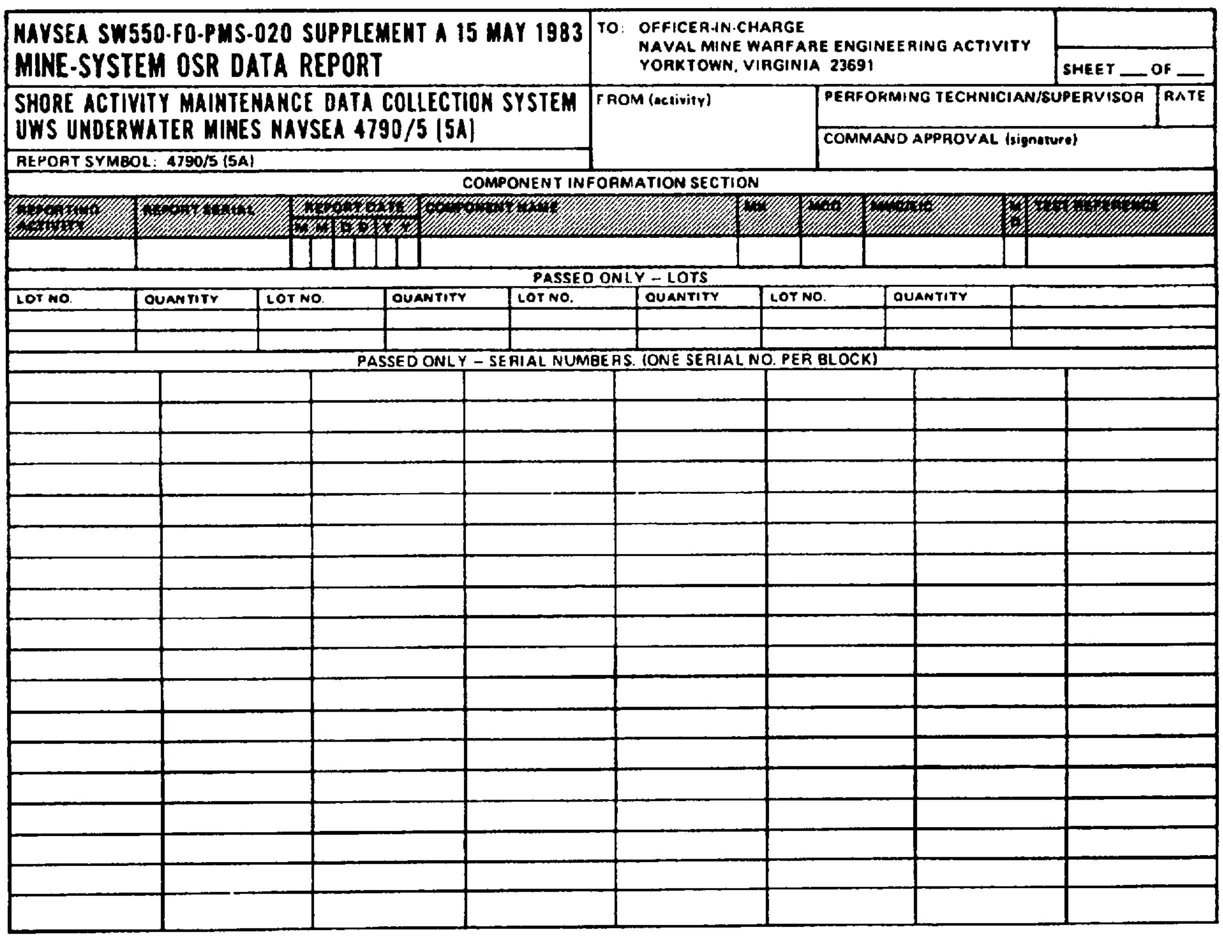

NAVSEA SW550-FO-PMS-020 SUPPLEMENT A 15 MAY 1983
MINE-SYSTEM OSR DATA REPORT
TO: OFFICER-IN-CHARGE
NAVAL MINE WARFARE ENGINEERING ACTIVITY
YORKTOWN, VIRGINIA 23691
SHEET ___ OF ___
SHORE ACTIVITY MAINTENANCE DATA COLLECTION SYSTEM
UWS UNDERWATER MINES NAVSEA 4790/5 (5A)
FROM (activity)
PERFORMING TECHNICIAN/SUPERVISOR
RATE
COMMAND APPROVAL (signature)
REPORT SYMBOL: 4790/5 (5A)
COMPONENT INFORMATION SECTION
PASSED ONLY – LOTS
LOT NO. | QUANTITY | LOT NO. | QUANTITY | LOT NO. | QUANTITY | LOT NO. | QUANTITY
PASSED ONLY – SERIAL NUMBERS. (ONE SERIAL NO. PER BLOCK)

Figure 1-1.—Supplement A, Mine System OSR Data Report.

Supplement-B Report

Supplement B, Mine System Class-B Data Report, shown in figure 1-2, is used to report results of intermediate-level tests and inspections of assembly-level mine items and subassemblies.

Specifically, this form is used to report the following items:

- Results of class-B criteria applied to assembly-level items at long-cycle maintenance, but only on those items designated as requiring the use of the supplement-B form in NAVSEA SW550-AA-MMI-010.
- Results of class-B criteria applied to assembly-level items before installation/issue, but only on those items designated as requiring the use of the supplement-B form in NAVSEA SW550-AA-MMI-010.
- Damage to explosive items as a result of handling while in storage. An accident investigation report, as prescribed in *Mishap Investigation and Reporting,* OPNAVINST 5102.1, is also required.

For further instructions on the preparation of supplement-B data reports, refer to NAVSEA SW550-FO-PMS-010.

SW550-FO-PMS-040 SUPPLEMENT B 15 MAY 1983
MINE SYSTEM CLASS B DATA REPORT

SHEET ____ OF ____

FOR NAVMINEWARENGACT USE ONLY

TO:
OFFICER-IN-CHARGE
NAVAL MINE WARFARE ENGINEERING ACTIVITY
YORKTOWN, VIRGINIA 23691

FROM: ACTIVITY

PERFORMING TECHNICIAN (PRINT) | RATE | QA INSPECTOR (SIGNATURE) | COMMAND APPROVAL (SIGNATURE)

1. REPORTING ACTIVITY ____ 2. REPORT SERIAL NO. ____ 3. REPORT DATE ____

4. PUBLICATION NUMBER ____ 5. VOLUME ____ 6. PART ____ 7. REVISION ____ 8. CHANGE ____

9. JOB SHEET NO. ____ 10. FUNCTION CODE ____ FC04 REMARKS ____ 11. MMC NO. ____ 12. BATTERY CODE __/__/__.__ MO YR MO/10

13. ITEM NAME ____ 14. MK ____ 15. MOD ____

16. QUANTITY PASSED ____ 17. QUANTITY PASSED AFTER ADJUSTMENT ____ 18. QUANTITY PASSED AFTER REPAIR [1] ____ 19. QUANTITY FAILED [1] ____

20. TOTAL QUANTITY TESTED FOR THIS REPORT ____ 21. SUBASSEMBLY TEST REPORT SERIAL NUMBER [2] ____

[1] *To report quantity "failed" or "passed after repair" use Supplement B continuation sheet.* DO NOT INCLUDE ITEMS IN "QUANTITY PASSED OR "QUANTITY PASSED AFTER ADJUSTMENT" ON CONTINUATION SHEET.

[2] *Enter subassembly test report serial number in item 21 when reporting test results of components suspected of causing subassembly to fail.*

Figure 1-2.—Supplement B, Mine System Class-B Data Report.

Supplement-E Report

Supplement E, Mine System Support-Material Data Report, shown in figure 1-3, is used to report intermediate-level maintenance actions that are not covered by supplement B. Supplement E provides a means for reporting only deficiencies (problems, errors, failures, etc.) and, as such, requires that the deficiencies be expressed verbally, not numerically.

Specifically, this form is used to report the following items:

- Results of class-B criteria applied to assembly-level items that were rejected at long-cycle maintenance and that are not reportable on supplement B.
- Results of class-B criteria applied to assembly-level items that failed class-B criteria before installation/issue and which are not reportable on supplement B.
- Problems dealing with improper packaging nomenclature, and labeling.
- Damage to handling equipment, tools, and facilities.
- Safety problems, logistical problems, and other problems not covered by supplement B.

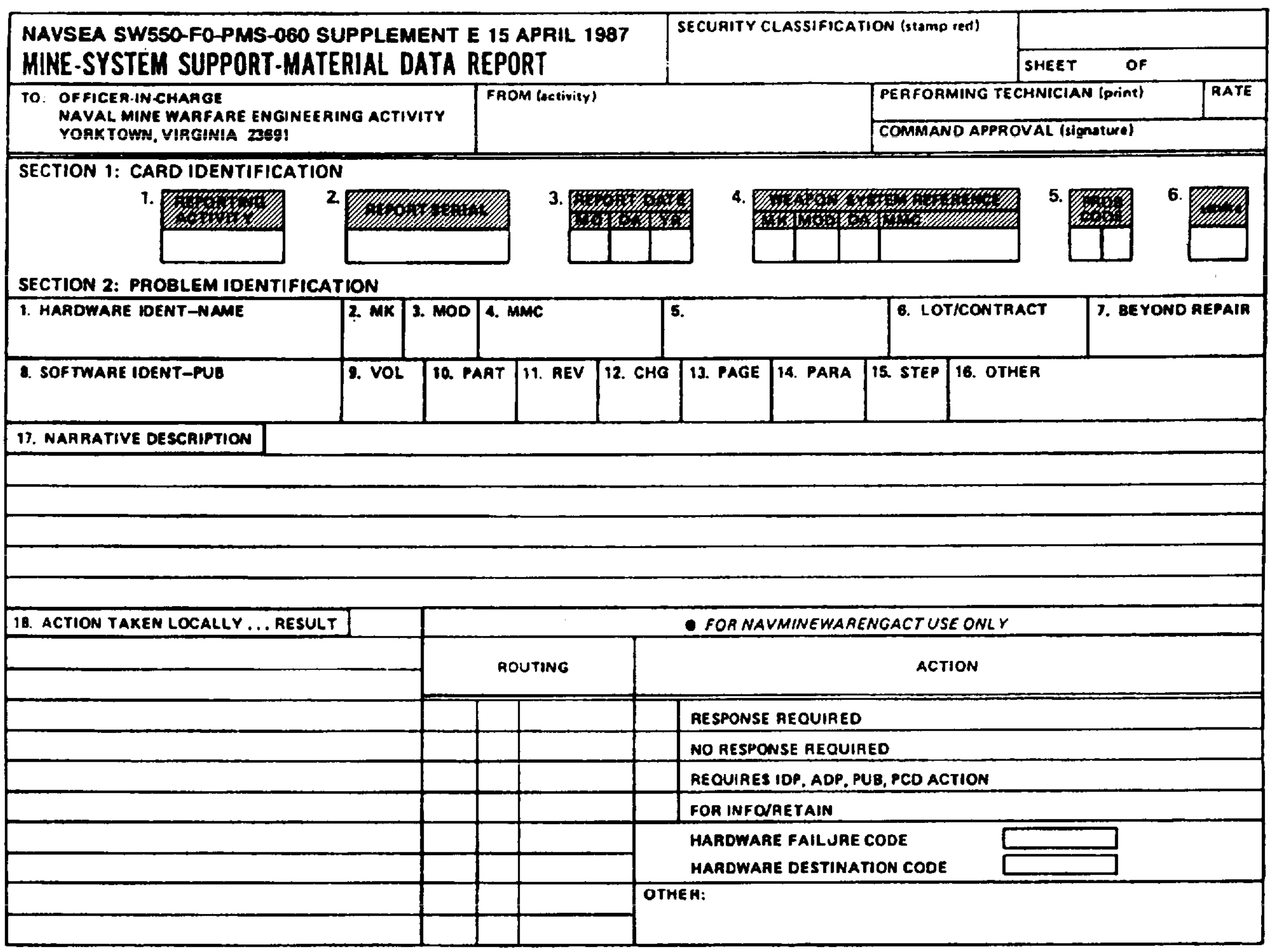

NAVSEA SW550-F0-PMS-060 SUPPLEMENT E 15 APRIL 1987
MINE-SYSTEM SUPPORT-MATERIAL DATA REPORT
SECURITY CLASSIFICATION (stamp red)
SHEET OF
TO: OFFICER-IN-CHARGE
NAVAL MINE WARFARE ENGINEERING ACTIVITY
YORKTOWN, VIRGINIA 23691
FROM (activity)
PERFORMING TECHNICIAN (print)
RATE
COMMAND APPROVAL (signature)
SECTION 1: CARD IDENTIFICATION
1. REPORTING ACTIVITY
2. REPORT SERIAL
3. REPORT DATE MO DA YR
4. WEAPON SYSTEM REFERENCE MK MOD DA MMC
5. PROB CODE
6. ADDL
SECTION 2: PROBLEM IDENTIFICATION
1. HARDWARE IDENT–NAME
2. MK
3. MOD
4. MMC
5.
6. LOT/CONTRACT
7. BEYOND REPAIR
8. SOFTWARE IDENT–PUB
9. VOL
10. PART
11. REV
12. CHG
13. PAGE
14. PARA
15. STEP
16. OTHER
17. NARRATIVE DESCRIPTION
18. ACTION TAKEN LOCALLY . . . RESULT
● FOR NAVMINEWARENGACT USE ONLY
ROUTING
ACTION
RESPONSE REQUIRED
NO RESPONSE REQUIRED
REQUIRES IDP, ADP, PUB, PCD ACTION
FOR INFO/RETAIN
HARDWARE FAILURE CODE
HARDWARE DESTINATION CODE
OTHER:

Figure 1-3.—Supplement E, Mine System Support-Material Data Report.

Supplement-F Record

Supplement F, Mine Mk 60 Assembly Record, shown in figure 1-4, is a limited use, computer-generated form. It is used to record serial numbers of selected components or assemblies removed and replaced (installed) in the Mine Mk 60.

NAVSEA SW550-F0-PMS-070 SUPPLEMENT F 02 DECEMBER 1993

MINE MK 60 ASSEMBLY REPORT

Performing Technician/Supervisor ____________________ Rate __________

Command Approval (signature) ____________________

WEAPON SERIAL NUMBER	MINE MOD	MINE OA	CONDITION CODE	BUILD DATE MO/YR	MAINTENANCE DATE DUE MO/YR	DASH
	01	01	TO A	/91		TO

DESCRIPTION	INSTALLED	REPLACED	REMARKS
BUOY (SERIAL)			ID#
TORPEDO MK 16			MDD : MOD:
SIGNAL PROGRAMMER MK 8			
AMPLIFIER POWER MK 165			
AMPLIFIER POWER MK 166			
PWR SUP BATTERY MK 153			LOT : B/DC: C/DC:
STER ELEC ASSY MK 13			
PWR SUP BATTERY MK 154			DC:
SW SEPARATION MK 141			
SW PRESSURE MK 140			
SENSOR LOWER ASSY MK 13			
ANCHOR MK 60			M: D:
INITIATOR HYDRO MK 16			
SOURCE MK 11			
SENSOR U[[ER ASSY MK 14			

REMARKS:

L/C PRESSURE:

Figure 1-4.—Supplement F, Mine Mk 60 Assembly Record.

Supplement-J Record

Supplement J, Signal Programmer Assembly/Disassembly/Repair Record, shown in figure 1-5, is a limited use, computer-generated form. It is used to record the serial number of signal programmers assembled, disassembled, or repaired in the Mine Mk 60.

NOTE: Supplements F and J form data will be maintained by the IMA in such a way that selected component serial numbers can be linked to the mine serial number in which it is currently assembled.

SW550-F0-PMS-100 SUPPLEMENT J 01 FEBRUARY 1992

Signal Programmer Assembly/Disassembly/Repair Record

DATE OF THE FOLLOWING ACTIONS

Disassembly ____/____/____ Assembly ____/____/____ Repair ____/____/____

	IN		OUT
Removed From Weapon	________		________
Signal Programmer	________	Signal Programmer	________
Mod	________	Mod	________
Dash	________	Dash	________
CCM	________	CCM	________
Condition Code	________	Condition Code	________

	S/N RECEIVED	S/N REMOVED	S/N ADDED
Adapter	________	________	________
Power Supply (Ring 1)	________	________	________
Command Control (Ring 2)	________	________	________
Detector (Ring 3)	________	________	________
Receiver (Ring 4)	________	________	________
Tracker Assembly (Ring 5)	________	________	________
Processor Assembly (Ring 6)	________	________	________
Torpedo Programmer (Ring 7)	________	________	________

(Ring 2)	Verify it does not have EPROMs with date code 8320/8329	________
(Ring 2)	Verify U3 changed from Harris ROM S/N 3302-4300	________
(Ring 5)	Adjusted and Stenciled (Mod 0 to Mod 1 use)	YES ____ NO ____
(Ring 6)	Verify Foam Pad installed S/N 2801 and above	________

T/A /0 to 1/Repair: ATE S/N ________ DATE ________ P/A's ____/____

TEST REMARKS: ________________

LIST ALL ORDALTS PERFORMED: ________________

Figure 1-5.—Supplement J, Signal Programmer Assembly/Disassembly/Repair Record.

Message Format for Supplements B and E

A message is used in lieu of supplements B and E data reports to report critical defects and failures in mine components that require an immediate response from the NAVMINEWARENGACT to resolve the situation. Example: A message report would be required if the failure rate of a component exceeded the 25-percent rejection rate of a maintenance lot. For further information and guidance, refer to NAVSEA SW550-FO-PMS-010.

MASTER RECORD SHEET

The master record sheet (MRS) is officially designated as the Assembly/Maintenance Master Record. It is covered by six forms: supplements G, H, K, L, M, and N of NAVSEA SW550-FO-PMS-010.

These supplements are used by mine-assembly personnel to provide assembly and maintenance data on a mine and to provide the operational settings relative to that mine. These supplements are shown in figures 1-6 through 1-11.

CONFIDENTIAL (When Mine Setting Code strip is attached)

UIC:____________ Lot No:__________

XPL SECT/MECH MTCHD Ser Nos: ______/______
PRESS DET/FIR MECH MTCHD Ser Nos: ______/______
MEFC No: ______ DATE: ______
MEFC No: ______ DATE: ______
MEFC No: ______ DATE: ______

SW550-FO-PMS-080 SUPPLEMENT G 01 FEB 1990
ASSEMBLY/MAINTENANCE MASTER RECORD
FOR MINES MK 52/55 MODS 2, 3, 12, 13, AND MINES MK 56

MINE SETTING CODE (FROM MINE SETTING SHEET FOLDER)

MINE NUMBER	MK/MOD	OA	STERILIZE OR S D	DA/OR (DAYS, HRS, MIN)	SHIP COUNT	LP	ICDP	IN-OUT	SENS		SENS	ILDP			NOTE	FIELD NO.	CHANGE	OPTIONAL
1	3	4	5	6	7	8	9	10	11-M	11	11-P	12	13	14	15	16	17	18

(All actions performed IAW applicable pubs)

ITEM	SERIAL NUMBER	MK	MOD	OA	WEAPON CONFIG	LONG CYCLE	SHORT CYCLE	ACTION	DATE	SUPERVISOR	INSPECTOR

Explosive Devices Serial/Lot Numbers

BATTERY MK ____ EFFECTIVE LIFE* _____ MONTHS AS OF _____ (DATE)
BATTERY MK ____ EFFECTIVE LIFE* _____ MONTHS AS OF _____ (DATE)
BATTERY MK ____ EFFECTIVE LIFE* _____ MONTHS AS OF _____ (DATE)
BATTERY MK ____ EFFECTIVE LIFE* _____ MONTHS AS OF _____ (DATE)
BSTR MK ______ MOD ______ ______

PROPELLANT ASSY ______________

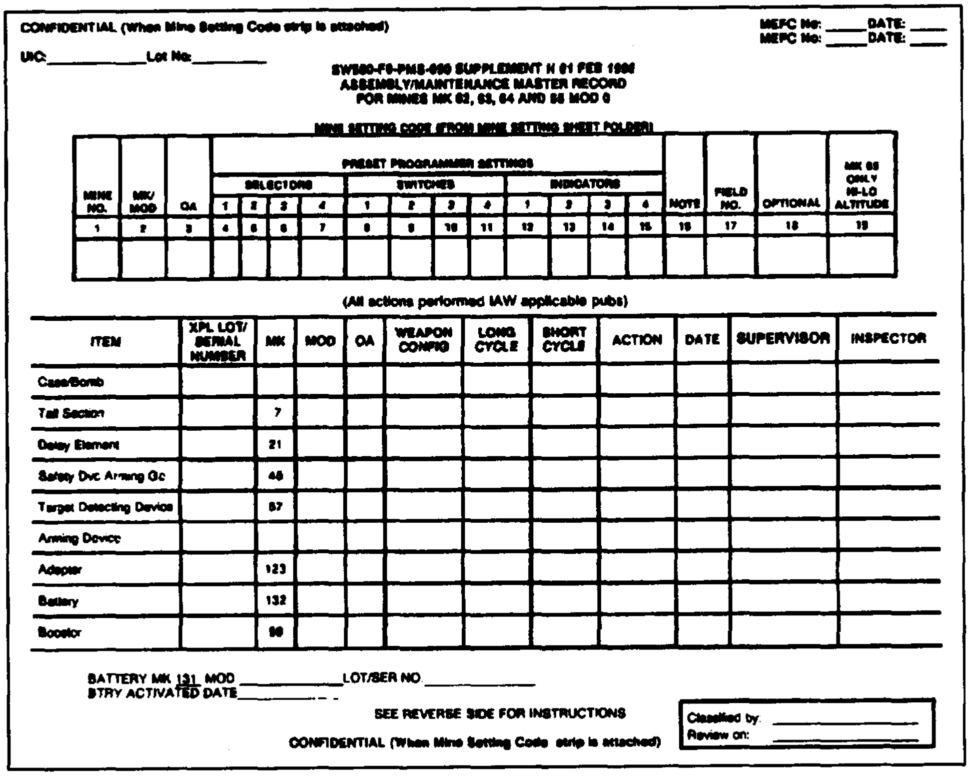
*Remaining useful storage life at expected storage temperature.

SEE REVERSE SIDE FOR INSTRUCTIONS

CONFIDENTIAL (When Mine Setting Code strip is attached)

Classified by: ______________
Review on ______________

Figure 1-6.—Supplement G, Master Record for Mines Mk 52/55 Mods 2, 3, 12, 13, and Mine Mk 56.



CONFIDENTIAL (When Mine Setting Code strip is attached)

MEFC No: _____ DATE: _____
MEFC No: _____ DATE: _____

UIC: __________ Lot No: __________

SW560-F0-PMS-090 SUPPLEMENT H 01 FEB 1996
ASSEMBLY/MAINTENANCE MASTER RECORD
FOR MINES MK 62, 63, 64 AND 65 MOD 0

MINE SETTING CODE (FROM MINE SETTING SHEET FOLDER)

MINE NO.	MK/ MOD	OA	PRESET PROGRAMMER SETTINGS												NOTE	FIELD NO.	OPTIONAL	MK 65 ONLY HI-LO ALTITUDE
			SELECTORS				SWITCHES				INDICATORS							
			1	2	3	4	1	2	3	4	1	2	3	4				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

(All actions performed IAW applicable pubs)

ITEM	XPL LOT/ SERIAL NUMBER	MK	MOD	OA	WEAPON CONFIG	LONG CYCLE	SHORT CYCLE	ACTION	DATE	SUPERVISOR	INSPECTOR
Case/Bomb											
Tail Section		7									
Delay Element		21									
Safety Dvc Arming Gc		45									
Target Detecting Device		57									
Arming Device											
Adapter		123									
Battery		132									
Booster		90									

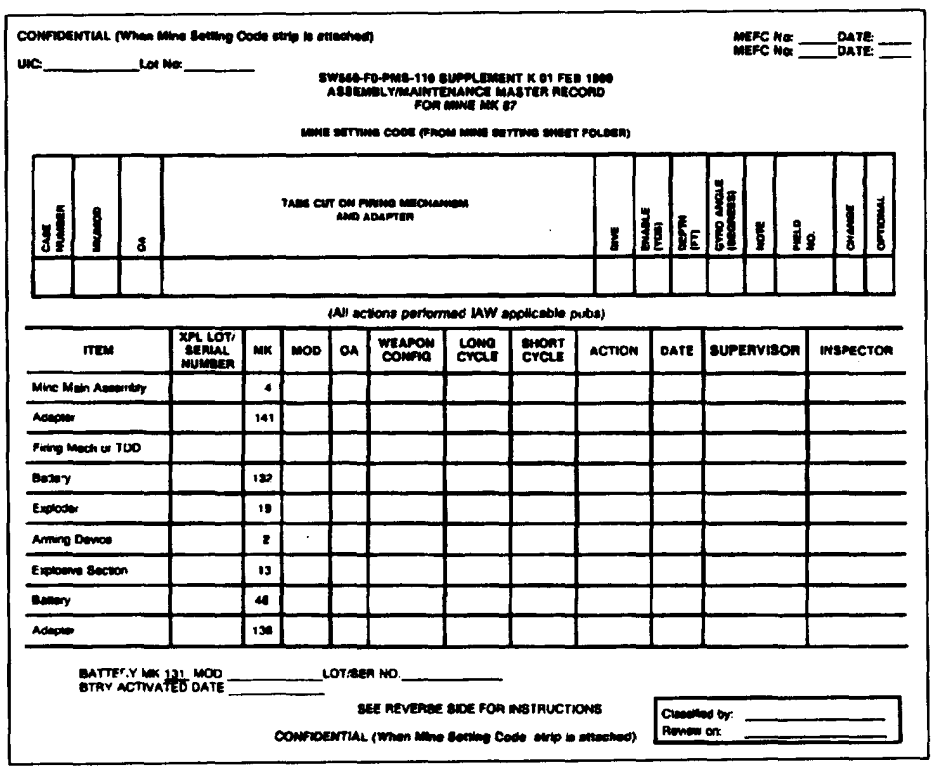
BATTERY MK 131 MOD __________ LOT/SER NO. __________
BTRY ACTIVATED DATE __________

SEE REVERSE SIDE FOR INSTRUCTIONS

Classified by: __________
Review on: __________

CONFIDENTIAL (When Mine Setting Code strip is attached)

Figure 1-7.—Supplement H, Master Record for Mines Mk 62, 63, 64, and 65 Mod 0.



CONFIDENTIAL (When Mine Setting Code strip is attached)

MEFC No: _____ DATE: _____
MEFC No: _____ DATE: _____

UIC: __________ Lot No: __________

SW560-F0-PMS-110 SUPPLEMENT K 01 FEB 1990
ASSEMBLY/MAINTENANCE MASTER RECORD
FOR MINE MK 67

MINE SETTING CODE (FROM MINE SETTING SHEET FOLDER)

CASE NUMBER	MK/MOD	OA	TABS CUT ON FIRING MECHANISM AND ADAPTER	SIVE	ENABLE (YES)	DEPTH (FT)	GYRO ANGLE (DEGREES)	NOTE	FIELD NO.	CHANGE	OPTIONAL

(All actions performed IAW applicable pubs)

ITEM	XPL LOT/ SERIAL NUMBER	MK	MOD	OA	WEAPON CONFIG	LONG CYCLE	SHORT CYCLE	ACTION	DATE	SUPERVISOR	INSPECTOR
Mine Main Assembly		4									
Adapter		141									
Firing Mech or TDD											
Battery		132									
Exploder		19									
Arming Device		2									
Explosive Section		13									
Battery		48									
Adapter		136									

BATTERY MK 131 MOD __________ LOT/SER NO. __________
BTRY ACTIVATED DATE __________

SEE REVERSE SIDE FOR INSTRUCTIONS

Classified by: __________
Review on: __________

CONFIDENTIAL (When Mine Setting Code strip is attached)

Figure 1-8.—Supplement K, Master Record for Mine Mk 67.

CONFIDENTIAL (When Mine Setting Code strip is attached)

UIC ____________ Lot No ____________

MEFC No: _____ DATE: ____
MEFC No: _____ DATE: ____

SW550-FD-PMS-120 SUPPLEMENT L 01 FEB 1990
ASSEMBLY/MAINTENANCE MASTER RECORD
FOR MINE MK 60

FLEET PLANNING NUMBER	UPPER CASE NUMBER	DELIVERY VEHICLE	REMARKS

MINE SETTING CODE (FROM FIELD ORDER)

CASE NUMBER	MK MOD	FIELD NUMBER SEGMENT	ROW NUMBER	CHANGE NUMBER	OA	CCM	(-) FREQ/PROM	SWITCH SETTINGS A/B	C/D	E/F	G/H	I/J	K/L	M/N	P/R	NOTES

INSERT GUMMED LABEL FROM FIELD SETTING SHEET

(All actions performed IAW applicable pubs)

ITEM	SERIAL NUMBER	MK	MOD	OA	WEAPON CONFIG	LONG CYCLE	SHORT CYCLE	ACTION	DATE	SUPERVISOR	INSPECTOR

SEE REVERSE SIDE FOR INSTRUCTIONS

CONFIDENTIAL (When Mine Setting Code strip is attached)

Classified by ____________
Review on ____________

Figure 1-9.—Supplement L, Master Record for Mine Mk 60.

CONFIDENTIAL (When Mine Setting Code strip is attached)

UIC: ____________ Lot No ________

MEFC No: _____ DATE: ____
MEFC No: _____ DATE: ____

SW550-FD-PMS-130 SUPPLEMENT M 01 FEB 1990
ASSEMBLY/MAINTENANCE MASTER RECORD
FOR MINE MK 65 MOD 1

MINE SETTING CODE (FROM MINE SETTING SHEET FOLDER)

CASE (MINE) NO	MK/MOD	OA	PRESET PROGRAMMER SETTINGS 1	2	3	4	5	6	7	8	9	10	NOTE	FIELD NO	OPTIONAL
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

(All actions performed IAW applicable pubs)

ITEM	XPL LOT/ SERIAL NUMBER	MK	MOD	OA	WEAPON CONFIG	LONG CYCLE	SHORT CYCLE	ACTION	DATE	SUPERVISOR	INSPECTOR
Case		65									
Tail Section		7									
Delay Element		21									
Safety Dvc Arming Gp		45									
Target Detecting Device		58									
Arming Device		2									
Battery		132									

BATTERY MK 131 MOD ____________ LOT/SER NO ____________
BTRY ACTIVATED DATE ____________

SEE REVERSE SIDE FOR INSTRUCTIONS

CONFIDENTIAL (When Mine Setting Code strip is attached)

Classified by ____________
Review on ____________

Figure 1-10.—Supplement M, Master Record for Mine Mk 65 Mod 1.

CONFIDENTIAL (When Mine Setting Code strip is attached)

MEFC No: _____ DATE: _____
MEFC No: _____ DATE: _____

UIC: ____________ Lot No: _________

SW550-F0-PMS-140 SUPPLEMENT N 01 FEB 1990
ASSEMBLY/MAINTENANCE MASTER RECORD
FOR DST's AND MINES MK 52/55 MOD 11

MINE SETTING CODE (FROM MINE SETTING SHEET FOLDER)

MINE NUMBER	MK/MOD	OA	TABS CUT ON FIRING MECHANISM AND BATTERY	NOTE	FIELD NO.	CHANGE	OPTIONAL
1	3	4		5	6	7	8

(All actions performed IAW applicable pubs)

ITEM	XPL LOT/ SERIAL NUMBER	MK	MOD	OA	WEAPON CONFIG	LONG CYCLE	SHORT CYCLE	ACTION	DATE	SUPERVISOR	INSPECTOR
Case/Bomb											
Arming Device		32									
Booster		59									

BATTERY MK ___ EFFECTIVE LIFE* ____ MONTHS AS OF _____ (DATE)

*Remaining useful storage life at expected storage temperature.

SEE REVERSE SIDE FOR INSTRUCTIONS

CONFIDENTIAL (When Mine Setting Code strip is attached)

Classified by: ______________
Review on: ______________

Figure 1-11.—Supplement N, Master Record for DSTs and Mines Mk 52/55 Mod 11.

When mines are upgraded to configuration A, B, or C, an MRS (original and duplicate) is prepared and filed locally until the mine is either planted or downgraded to configuration E. At that time, the MRS is destroyed since MRSs are only required on mines in configurations A, B, and C.

If the mine is placed on board an aircraft carrier, a copy of the MRS accompanies the mine. If the mine is planted, duplicate copies of all MRSs are retained for reference and originals are forwarded to the Commander, Mine Warfare Command (COMINEWARCOM).

Any mine operational setting changes made after the initial assembly must be recorded on the master record sheet.

CORROSION CONTROL

To perform mine maintenance properly, you must be familiar with the types and causes of corrosion and the common types of materials available for use in corrosion prevention and in protection against moisture. You must know what materials to use for cleaning and removing corrosion from the equipment and how to use the cleaning materials properly. You must also understand the procedures for, and know the equipment used in, applying preservatives.

Metal corrosion is the deterioration of metal as it combines with oxygen to form metallic oxides. The most significant corrosion element is oxygen. Oxidation, the combining of wood or metal with oxygen, is the process that causes wood to rot or burn and metal to corrode.

Corrosion is caused by either electrochemical or direct chemical reaction of metal with an oxidizing agent. The most familiar process of corrosion is a reaction between metal and moisture and is electrochemical in nature. In the direct chemical attack, the reaction is similar to that which occurs when acid is applied to bare metal.

Corrosion is more serious under wet and humid conditions than it is under dry conditions. Salt in the air also promotes corrosion. Factors that influence corrosion to a lesser or greater degree include types of metal, grain direction of metal, manufacturing and operational stress, contact by dissimilar metals, and environment. Of these factors, the environment is the major one. Moisture and salt are the two most common elements of the environment that influence corrosion.

Corrosion control depends on a separation between the metal or wood and the environment. The separation is accomplished in different ways. On mines, a good coat of paint provides most of the corrosion protection. However, grease and other lubricants are used at seams to prevent entry of moisture, and preservatives are used on unpainted surfaces. Tarpaulins, covers, and caps provide some, but not 100-percent, protection. Although paint is a preservative and provides excellent protection, it is subject to oxidation and decay through weathering. Lubricants are eroded by water and moisture, and preservatives offer only temporary protection.

An important part of mine warfare is the maintenance of the stored weapons in an RFI status. This is the reason mines and associated equipment are maintenance on a regular basis, as discussed earlier in this chapter. Corrosion control is an important part of this maintenance.

This section discusses the common materials used in the construction of mines (such as steel, aluminum, stainless steel, and thermal-coated surfaces) and the characteristics of corrosive products that can develop on these materials.

STEEL SURFACES

Steel is used in the manufacturing of Mine Cases Mk 52, Mk 55, and Mk 65; Bombs Mk 80 series used for Destructors Mk 36, Mk 40, and Mk 41; Quickstrikes Mk 62, Mk 63, and Mk 64; and Anchor Mk 56. Steel is susceptible to a well-known and easily recognized form of metal corrosion, the familiar reddish-colored rust. When steel starts to corrode, dark iron oxide usually forms first. This iron oxide may act to protect the steel surface; however, if sufficient oxygen and moisture are present, the oxide converts to hydrate ferric oxide, common red rust.

The procedure to remove corrosion from the steel surfaces of mines depends on the protective coating on the surfaces. Minor corrosion scratches, or burrs may be removed from surfaces with no protective coating, such as flanges at watertight openings, by hand polishing with abrasive cloth or copper wool. These flanged surfaces are then cleaned with a cleaning compound solvent and protected with a thin coat of grease. With respect to flanges on tail covers, arming-device well covers, and blanking plates, corrosion may be removed by using a glass bead blaster.

Steel surfaces that have a plating material are subject to corrosion in the form of a white powder. This white powder may be removed by using a cloth dampened with fresh water. A plated surface with discoloration requires no treatment for corrosion, because the plating is still offering sacrificial protection for the base metal. Corrosion of the base metal, commonly referred to as rust, will occur after the plating is destroyed. Rust from plated surfaces may be removed by using copper wool. Flange surfaces at watertight openings that have had corrosion removed must be protected with a thin coat of grease, and other areas where base metal is exposed must be protected with primer.

Painted steel surfaces with chipped, loose, blistered, or cracked paint or corrosion of the base metal of all assembly-level items can be repaired by using wire brushes, abrasive cloths, or power tools. When you use power teds or wire brushes on explosive-loaded mine cases, try to avoid creating dangerous hot spots.

When the surface condition of a mine case is poor, you may need to remove paint and corrosion by sandblasting. When sandblasting a mine case, take the following precautions:

1. Ensure that the mine case is securely connected to an earth ground.

2. Allow only experienced operators to sandblast explosive-loaded mine cases.

3. Wear personal protective equipment. Include a supplied-air sandblasting hood, shown in figure 1-12, and hearing and hand protection.

4. Use caution to avoid overheating of the case or reducing the thickness of the case excessively.

5. Close all openings on the mine case with blanking plates or covers, install extra nuts and screws to coverall exposed threads, remove suspension lugs, and fill lug holes with rags.

6. Use only sand or black grit (mineral grit) of 40 to 80 mesh.

7. Use an abrasive only once.

8. Do NOT sandblast in the immediate area of the filling hole cover.

9. Do NOT sandblast flange or sealing areas.

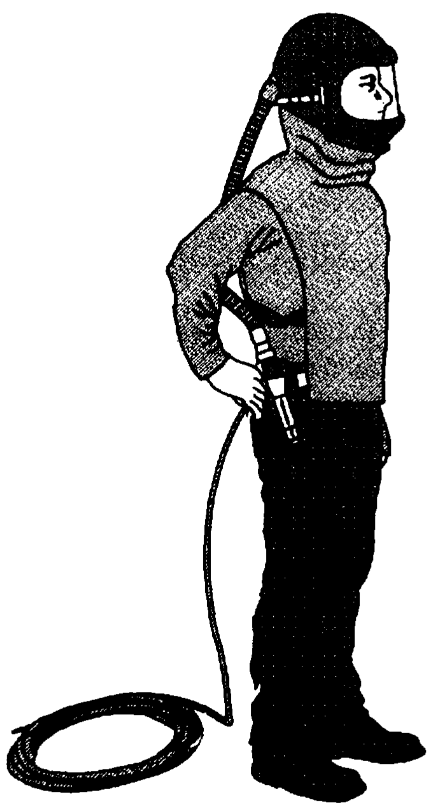


Figure 1-12.—Abrasive sandblasting hood.

ALUMINUM SURFACES

Aluminum in its pure state, is very resistant to corrosion, but it is too soft and weak for most applications. Therefore, aluminum alloys are used in the manufacture of the Mine Mk 67, as well as some mine components, such as actuation counters, clock delays, and flight gear. These are all subject to corrosive attacks.

Corrosion is most severe when moisture is present or when the aluminum is in contact with another type of metal or with another type of aluminum alloy. The first indication of corrosion is the appearance of white powdery residue in the area of contact. Later, pitting and scoring of the aluminum surface are evident. Finally, the aluminum deteriorates completely.

Use an abrasive cloth to remove corrosion from a painted aluminum surface. Then clean the surface with a cleaning compound solvent, prime with zinc chromate, and repaint with applicable paints as listed in chapter 2 of NAVSEA SW550-AA-MMI-010.

STAINLESS STEEL SURFACES

Stainless steel is an alloy of steel and chromium. The chromium helps to prevent corrosion. Stainless steel is used in manufacturing the Mine Mk 56 and its Mk 2 instrument rack. The surface of the metal has a tendency to pit when it is exposed to marine environment. Corrosion on stainless steel is indicated by either a rough surface or a red, brown, or black stain.

Use an abrasive cloth or a power tool to remove corrosion from stainless steel. After you remove the corrosion, you may need to apply a primer. This can be done in the following two steps:

1. Apply a solution of phosphoric acid and resin. (This application coats the surface with a plastic film that improves the adhesiveness of subsequent primer coats.)

2. Apply a coat of vinyl to protect the first primer coat as soon as practicable.

> **CAUTION**
>
> Phosphoric acid is highly corrosive. Wear goggles, a rubber apron, and chemical-resistant rubber gloves when handling acid. Read the material safety data sheet (MSDS), available from your supervisor, before handling or using phosphoric acid.

EXTERNAL THERMAL-COATED SURFACES

Bombs missing more than 7 square inches of thermal coating are not considered to be thermally protected and, therefore, are restricted from issue to aircraft carriers. Bombs missing less than 7 square inches can be repaired by using a putty knife or a cold chisel and a hammer to remove any unbended coating from the bomb body.

Particular attention should be given to the forward end. If the coating is unbended, it comes off in chunks. If the coating is bonded, it comes off in small chips and a residue is lefl on the bomb. Remove the coating in all directions from the unbended coating until the bonded coating is reached. Bombs with minor chips, cracks, etc., that are not rejected must have areas where the coating is missing touched up with primer.

On the Mk 65 mine, the thermal coat is epoxy-based with asbestos or ceramic fibers. Do not sand or make dust. The surface can be cut or shaped with a knife to define the repair area. Remove the minimum possible amount of material. Wear safety-approved organic vapor respirators, goggles, and gloves when using solvents or paint or when applying a thermal coat, Repair the mine in accordance with the instructions in NAVSEA SW550-AA-MMI-010.

PAINTING OF MINES

Painting is the process of applying coats of paint to surfaces, primarily for the preservation of the surfaces. It seals the pores of wood and steel, arrests decay, and helps prevent the formation of rust and other types of corrosion.

Basically, a paint job consists of one primer coat and one or more finish coats. The primer coat is the first coat applied to a properly prepared and cleaned surface. It improves the adhesiveness of the outer, or finish, coat or coats of paint and provides protection to the surface against corrosion. For color coding general stenciling, and more extensive repainting, refer to chapter 2 of NAVSEA SW550-AA-MMI-010.

The most common primer used in the mine force is zinc chromate. But zinc chromate paint dust is toxic; therefore, a respirator must be used during painting, sanding, and wire brushing operations. After the primer coat or coats are dry, one or more finish coats are applied

> **CAUTION**
>
> All paints and thinners are hazardous materials. Most of these materials are flammable or combustible and can be hazardous to worker health. Avoid prolonged skin contact with paints and thinners and wear approved respirator protection. Read the MSDS, available from your supervisor, for the specific hazardous materials before you handle or use them.

SHOP PROCEDURES

Specific shop procedures are approved for use with explosive-loaded components during the maintenance and assembly of mines and mine components. These procedures must be followed to prevent personal injury or damage to equipment and possible explosion.

This section discusses tools, painting equipment, and battery storage.

TOOLS

Tools used in Mine Force shop procedures include torques wrenches and power tools. These tools are discussed in the following subsections.

Torque Wrenches

Torque wrenches maybe either manual or pneumatic. NAVSEA SW550-AA-MMI-010 gives additional instructions in using torque wrenches.

MANUAL TORQUE WRENCHES.— Torques are generally specified in a single value, such as 18 pound-feet or 12 pound-inches. In such cases, torque tolerances are as follows:

- From 2 to 10, a tolerance of plus or minus 1 is allowed.
- From 11 to 30, a tolerance of plus or minus 2 is allowed.
- Above 30, a tolerance of plus or minus 5 is allowed.

Therefore, for a specified torque of 9 pound-inches, any applied torque between 8 and 10 pound-inches is acceptable. Torques specified in mine assembly procedures can be converted to or from pound-inches or pound-feet, as necessary, to accommodate the increment graduations of the torque wrench. This can be accomplished by multiplying pound-feet by 12 or by dividing pound-inches by 12, as appropriate.

When assembly instructions state to tighten mount, or secure an object (rather than giving a specific torque), fasteners must be tightened with the appropriate tool without the use of excessive pressure. Items specified to be secured hand-tight must never have tool pressure applied.

Reliability of a torque wrench can be improved before use by exercising the wrench a minimum of eight times at 60-percent of the rated torque range. This is accomplished by engaging the wrench with a test fastener and by applying the necessary pressure on the handle until the audible torque-indicating mechanism is activated.

Never attempt to apply a permanent torque value to a wrench by means of spot welding the micrometer at a given setting. That only damages the wrench and reduces the reliability of the instrument.

PNEUMATIC TORQUE WRENCHES.— Pneumatic torque wrenches are adjustable power torque tools that require a working pressure of 90 pounds per square inch (psi) at the tool. When in proper calibration, pneumatic torque wrenches are authorized for both run-down and application of final torque to any fastener. Final torque, as used here, is the value specified in mine assembly and maintenance documents.

For the proper use of a pneumatic torque wrench, it must be connected to an air supply containing a moisture separator, an air-pressure regulator, and a means of introducing lubrication oil into the wrench. Accordingly, the torque wrench must be connected to the simple system shown in figure 1-13 or to the spiral flex system shown in figure 1-14.

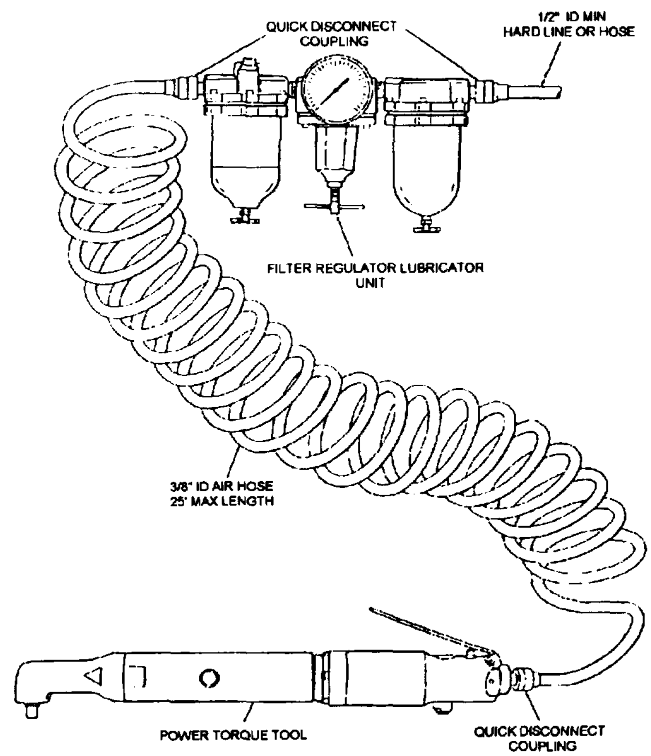


Figure 1-13.—Simple air distribution hookup.

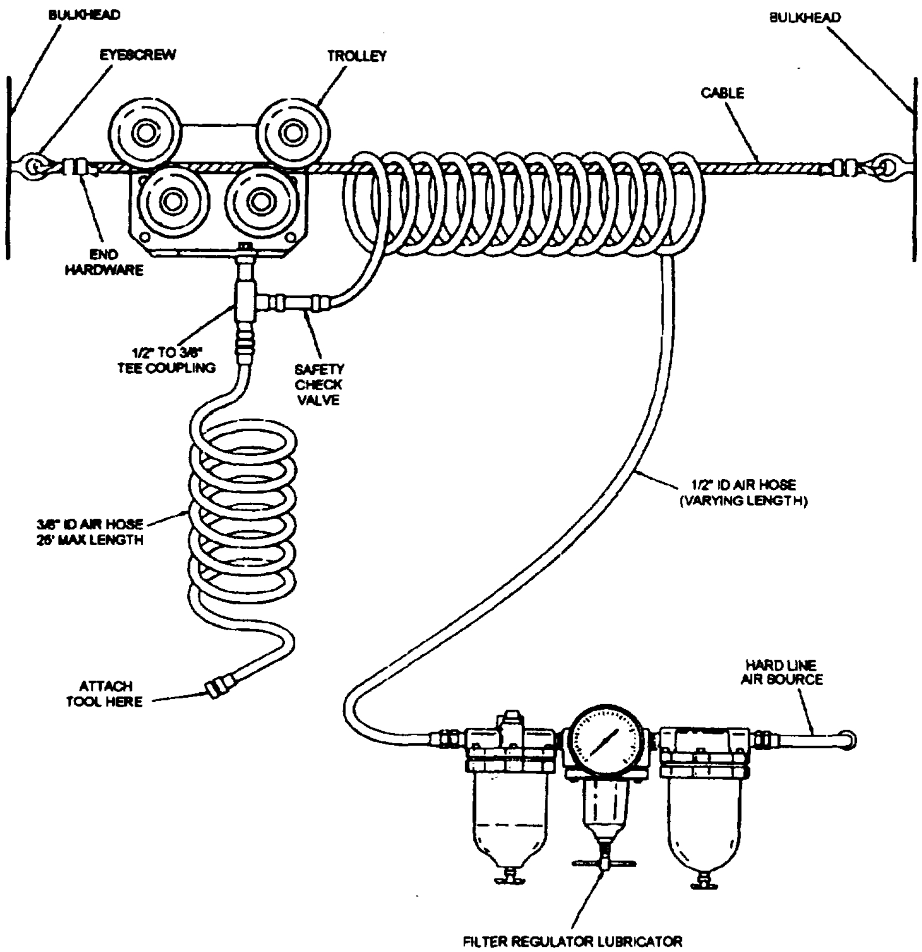


Figure 1-14.—Spiral flex system hookup.

Power Tools

Power tools are so common in the Navy that personnel in all ratings use some type of power tool at one time or another. The Mine Force uses both electric and air-driven pneumatic power tools and equipment.

Safe practices in the use of power tools cannot be overemphasized. The following general safety measures must be observed when operating or maintaining power tools:

- NEVER operate a power tool unless you are thoroughly familiar with its controls and operating procedures.

- ALWAYS inspect all power tools before use to ensure that they are clean and in the proper state of repair.

- ALWAYS ensure that the switch on the tool is in the OFF position before connecting the power tool to a power source (electricity, air, etc.).

- ALWAYS give the power tool your FULL and UNDIVIDED attention when you are operating it.

- ALWAYS keep all safety shields in position. Wear hearing protection and safety glasses or goggles.

- ALWAYS ensure that the work area has ample lighting.

- ALWAYS fasten loose-fitting clothes or, better yet, do NOT wear such clothing. Wear snug-fitting clothes.

- ALWAYS remove the power source before cleaning or working on jammed machinery.

- ALWAYS connect the electrical power tool to the extension cord before connecting the extension cord into the outlet, if an extension cord is used. Always unplug the extension cord from the outlet before disconnecting the power tool from the extension cord. (The extension cord and the power tool cord combined must not be longer than 25 feet each, or 50 feet in total footage.

ELECTRIC POWER TOOLS.— Electric power tools are authorized provided that no electro-explosive devices (EEDs) are installed. Some of the most common electric power tools used in the Mine Force include drills, saws, and sanders.

The most frequently used electric power tool in the Mine Force is the drill. Although it is especially designed for drilling holes, it can be used for sanding paint mixing and wire brushing when accessories are added. A portable electric drill is classified by size according to the maximum size of the straight shank drill it will hold. For example, a 1/4-inch portable electric drill will hold any straight-shank drill up to and including a 1/4-inch drill.

The revolutions per minute (rpm) and the power the drill delivers are the most important points when a drill is being chosen for a particular job. The speed of the drill motor decreases as the size of the drill increases. The speed of electric power tools used on explosive-loaded components must NOT exceed 2,000 rpm. Therefore, you must be careful in selecting a tool for a particular job.

When using nonferrous wire-wheel brushes or fabric wheels with a drill, the diameter of the wheels must not exceed 8 inches. Electric nonferrous wire-wheel brushes and fabric wheels are especially useful on work where a large amount of paint must be removed from the surface to be painted. When using a nonferrous wire-wheel brush or a fabric wheel, move it smoothly and lightly over the surface. Never allow the brush to stay in one place too long; it could cause a hot spot on the metal and will create an explosive hazard. The brush could also cut into the metal, leaving a depression that maybe cause for the component's rejection.

Electric power tools are authorized for use in mine assembly, disassembly, and maintenance. Electric tools soused must be electrically grounded in accordance with applicable safety regulations in volume 1 of *Ammunition and Explosives Ashore; Safety Regulations for Handling, Storing, Production, Renovation, and Shipping,* NAVSEAOP 5. No tools of any type (power or manual) are authorized for use at the intermediate level on filling hole covers.

PNEUMATIC POWER TOOLS.— Pneumatic rotary and reciprocating motor power tools are also authorized for use on explosive-loaded mine cases that are properly grounded and that have no EEDs installed. The same restrictions that apply to electric power tools also apply to rpm and size of nonferrous and fabric wheels used with pneumatic power tools.

Pneumatic wrenches are designed to give optimum performance with 90 psi of air at the tool when running. Every effort should be made to ensure that the line pressure is correct and that the pressure or the volume has not been reduced at the tool by undersized hose, hose menders, undersized bushings, or quick-connect couplings that restrict the air flow.

PAINTING EQUIPMENT

In the Navy, the basic painting equipment includes spray guns and their associated equipment, paint rollers, and paint brushes. Each of these items is discussed in the following subsections.

Spray Guns

A spray gun is a precision tool in which air and paint are separately directed into the area where the paint is atomized before it is sprayed on the surface being painted. The mixing area may be outside or inside the gun's spray cap.

Spray guns are classed according to where the air and the paint are mixed (external or internal), how the air is controlled (bleeder or nonbleeder), and how the gun is supplied with fluid (suction feed or pressure feed).

● External-mix gun: In an external-mix gun, the air and the paint are mixed outside, in front of the external-mix air cap. This type of gun requires high air pressure; thus, it uses more cubic feet of air per minute than an internal-mix gun. Atomization of the paint is extremely tine and the size of the spray pattern can be controlled. There is no wear on the nozzle. By the use of difererent nozzles, an external-mix gun works with both suction and pressure feed systems. See figure 1-15.

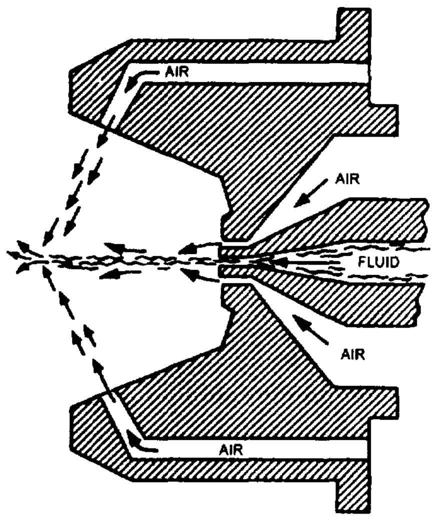


Figure 1-15.—External-mix air cap.

● Internal mix gun: In an internal-mix gun, the air and the paint are mixed within the internal-mix air cap. In this type of gun, atomization of the paint is coarse, and the spray pattern is fixed. The gun works only with a pressure feed, but the pressure is lower and the amount of air used is less than for the external-mix gun. Because atomization of the paint is coarse, more paint is applied on each pass. See figure 1-16.

● Bleeder gun: A bleeder gun allows the air to leak or bleed from some part of the gun to prevent the air pressure from building up in the hose. In this type of gun, the trigger controls the fluid. The gun is generally used with a small air compressor that has no pressure control on the air line.

● Nonbleeder gun: A nonbleeder gun is equipped with an air valve that shuts off the air when the trigger is released. It is used with a compressor that has a pressure-controlling device.

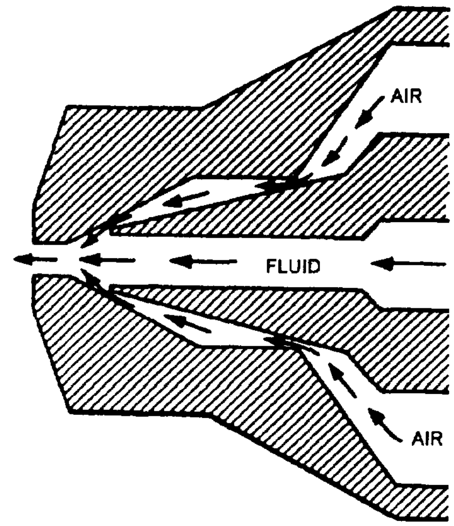


Figure 1-16.—Internal-mix air cap.

● Suction-feed gun: A suction-feed gun has a suction-feed air cap that draws the fluid from the container by suction in about the same way that an insect spray gun operates. The suction-feed guns are usually used with one quart (or smaller) containers. See figure 1-17.

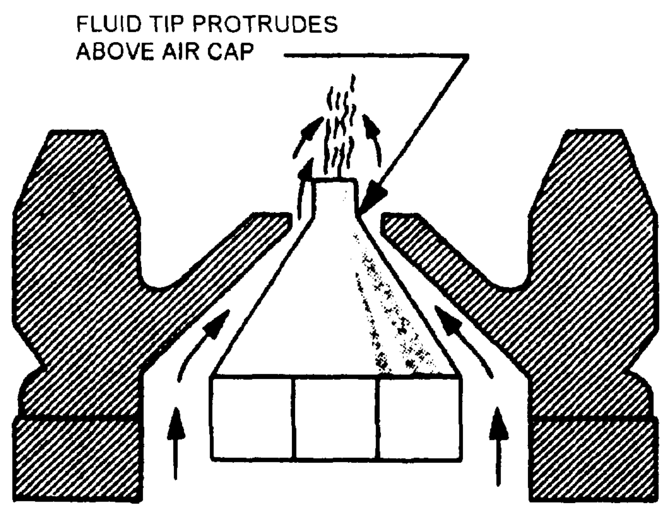


Figure 1-17.—Suction-feed air cap.

● Pressure-feed gun: A pressure-feed gun operates by air pressure. The air pressure forces the fluid from the container into the gun. This type of gun, with a pressure-feed air cap, is used for large-scale painting. See figure 1-18.

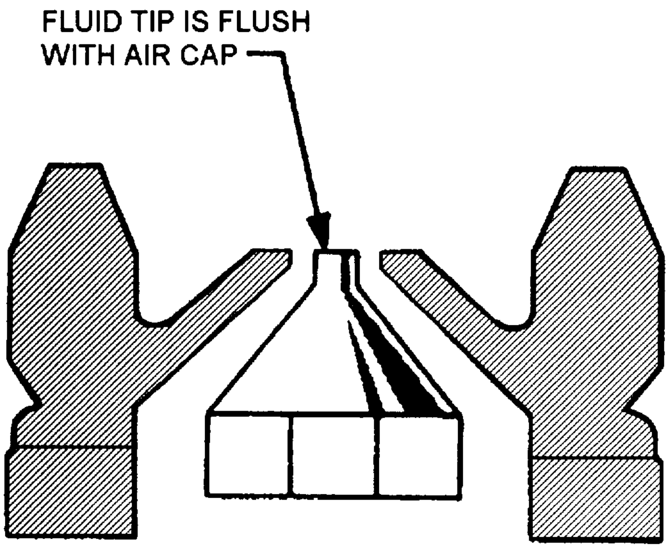


Figure 1-18.—Pressure-feed air cap.

SPRAY GUN ASSEMBLIES AND COMPONENTS.— The two main assemblies of a spray gun are the gun body and the spray head. Each assembly is a collection of small parts designed to do specific jobs.

● Gun body: The principal parts of the gun body assembly are shown in figure 1-19. The air valve controls the air supply and is operated by the trigger. The air-control screw regulates the amount of air supplied to the spreader horn holes of the cap, thus varying the paint pattern. The adjustment has a dial that can be set to give the pattern desired. The fluid needle adjustment controls the amount of spray material that passes through the gun. The spray-head locking bolt locks the gun body and the removable spray head together.

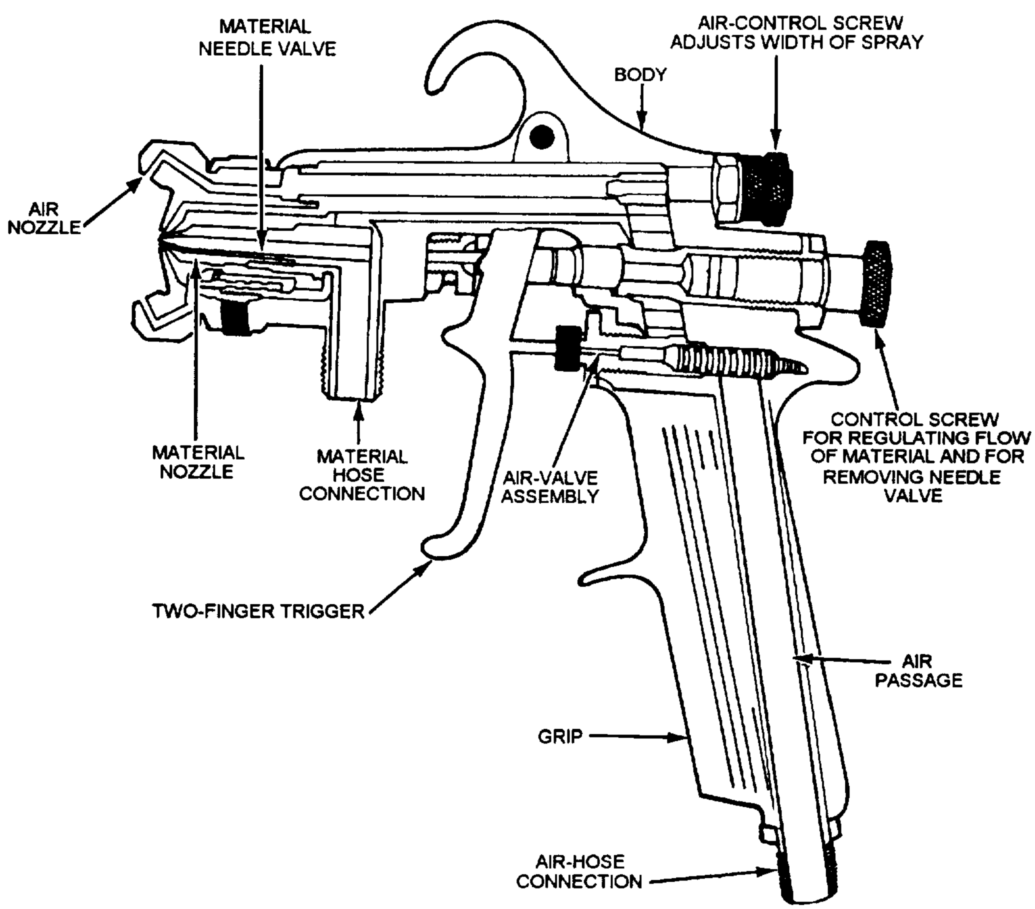


Figure 1-19.—Cross-section of a spray gun.

● Spray head: Most spray guns have a removable spray-head assembly. This type of gun has several advantages. For example, it is easier to clean; it permits you to change the head quickly when you want to use anew material or a new color of material; and the head is replaceable when damaged. The principal parts of the spray-head assembly are the (1) air cap, (2) fluid tip, (3) fluid needle, and (4) spray-head barrel. The fluid tip regulates the flow of the spray material into the air stream and encloses the end of the fluid needle. The spray-head barrel is the housing that encloses the spray-head mechanism. See figure 1-20.

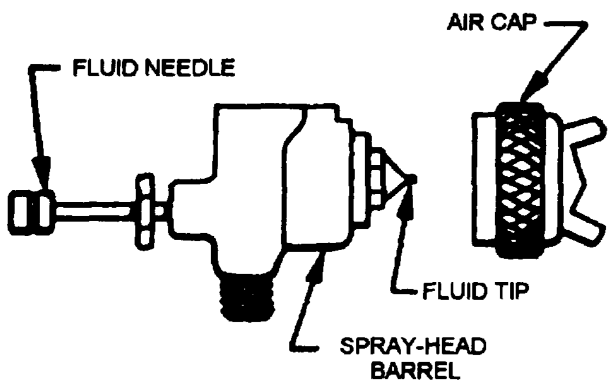


Figure 1-20.—Principal parts of the spray-head assembly.

●Material containers: The material containers are the cups that hold the spray material before delivery to the gun. The type of painting job determines which of the several kinds of containers should be used. **Suction-feed cups** are used for small quantities of lightweight and mediumweight spray materials, such as lacquers. **Gravity-feed cups** are small and are attached directly to the top or side of the gun. Normally, they are used only on artist's and decorator's guns or on small touch-up guns. **Pressure-feed cups** are best for handling small quantities of enamels, plastics, or other heavy materials on jobs where fine adjustments and speed of application are needed. See figure 1-21.

● Hose lines: The hose lines used for spray guns are of two types: one handles air; the other handles liquids. The air hose is usually made of braid-covered tubing of either one-braid or two-braid construction. The fluid hose is made of a special solvent-resistant material that can withstand the attacks of paint, lacquer, and similar liquids.

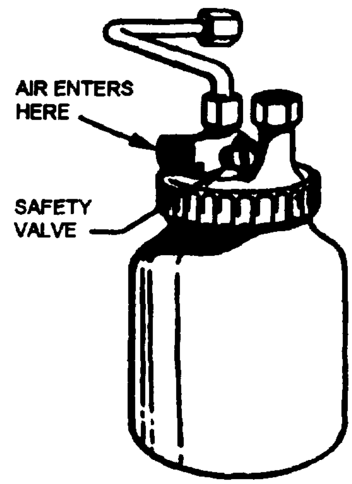


Figure 1-21.—Pressure-feed cup.

● Air Supply: The compressed air that operates spray guns is supplied by either portable or installed compressors. The air pressure from the compressors is usually set from 100 to 125 psi. The pressure is reduced to spraying pressure by a pressure-regulator valve. When using air compressors, follow the manufacturer's operating instructions. To properly spray paint ensure that the air is dry and free of dust. Since all air contains moisture and dust in varying amounts, some means must be provided to remove it. This is commonly done by an air transformer, frequently called an air separator or an air regulator. Air passing through the transformer enters through an air inlet and passes through a series of baflles and a filter chamber to a regulator diaphragm that adjusts the pressure. During normal weather conditions, the transformer should be drained daily. If the weather is damp, it should be drained several times daily. To drain the transformer, open the drain valve on the bottom of the unit. Change the packing and filter units also at regular intervals. See figure 1-22.

SPRAY GUN OPERATION.— When the trigger of a spray gun is squeezed, the air valve that admits compressed air through the air inlet opens. The air then passes through the gun body into the spray head. In the most common types of spray heads (external-mix), the air does not come in contact with the paint inside the gun, but is blown out through small holes drilled in the air cap. The paint is blown out of the nozzle in a thin jet. The force of the air striking the paint breaks the jet into a fine spray.

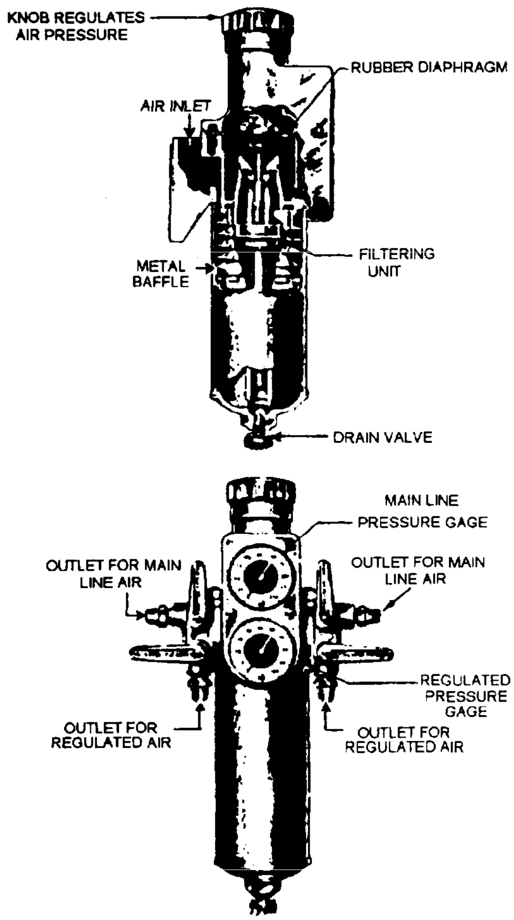


Figure 1-22.—Air transformer.

You can control this spray to produce various patterns by setting the air control screw that regulates the spreader adjustment valve.

- To get a round spray, turn the control screw counterclockwise.
- To get a fan spray, turn the control screw clockwise.
- To increase the flow of paint, turn the fluid control screw clockwise.
- To maintain the same coverage over a wider area, increase the flow of paint as you increase the width of the spray.

The use and handling of a spray gun are learned best by practice. The following paragraphs describe how to use a spray gun properly and include tips to help you use the gun more efficiently.

- Before starting to paint with a spray gun, check the adjustments and the operation of the gun by spraying paint on a surface similar to the one that you intend to paint.

- To do good work, use a minimum amount of pressure, holding the gun away from the work normally from 6 to 10 inches. However, there are no set rules for spray gun pressure or for the distance of the spray gun from the surface to be painted. The pressure and the distance vary considerably with the type of nozzle, the paint used, and the surface to be painted.

- For the paint to properly spray, always keep the gun perpendicular to and at the same distance from the surface being painted. Start the stroke before squeezing the trigger, and release the trigger before completing the stroke. If you do not hold the gun perpendicular or if you hold it too far away from the surface being painted, part of the paint spray will evaporate and will strike the surface in a nearly dry state. This condition is called *dusting.* If you fail to start the stroke before squeezing the trigger or if you fail to release the trigger before ending the stroke, the paint will build up at the end of the stroke and will run or sag. If you arch the stroke, you will not be able to deposit the paint in a uniform coat. See figures 1-23 and 1-24.

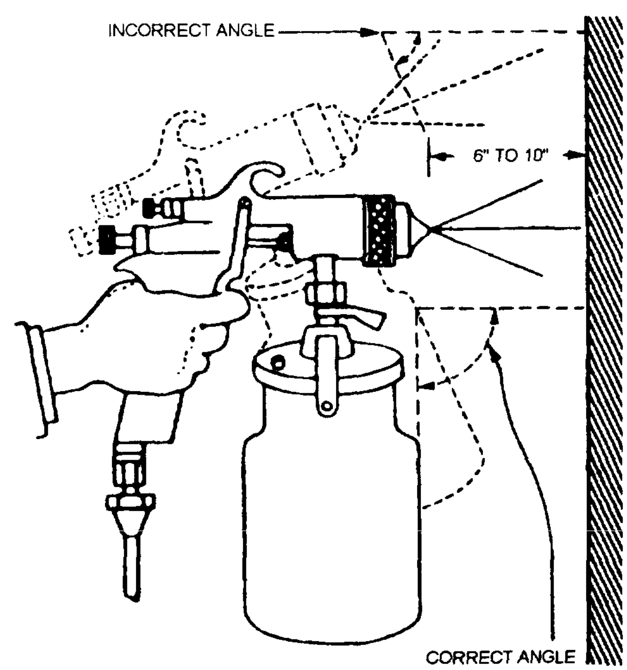


Figure 1-23.—Holding the spray gun perpendicular to the surface.

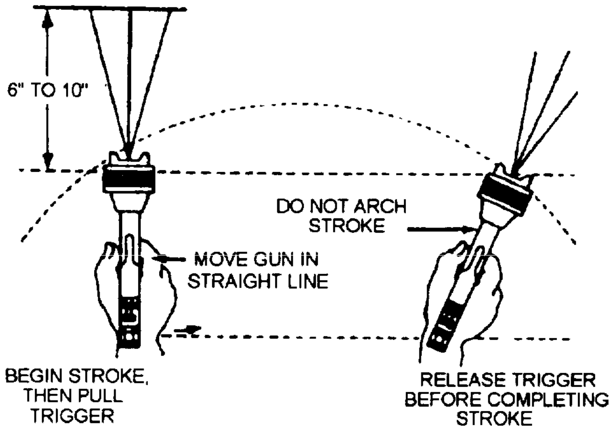


Figure 1-24.—Proper spray gun stroke.

● When spraying corners (both inside and outside), stop 1 or 2 inches short of the comers. Paint both sides of the comer the same. Then turn the spray gun on its side and, starting at the top, spray downward, coating both sides of the corner at the same time. See figure 1-25.

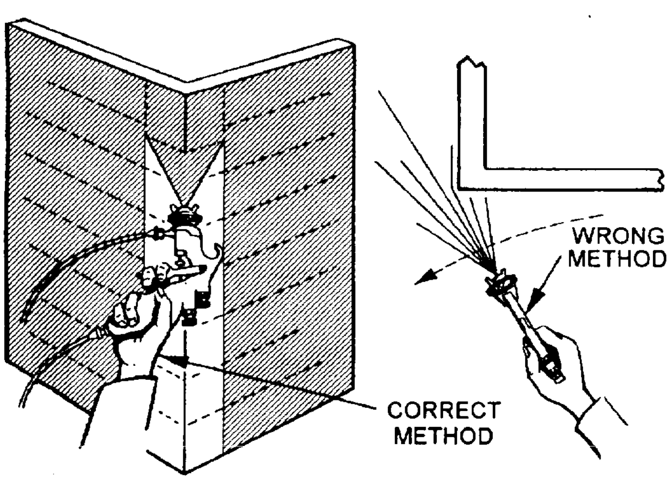


Figure 1-25.—Right and wrong ways of spray painting corners.

● When spraying a large area where small parts and pieces protrude, first coat the protruding items lightly and then coat the entire surface. For example, when painting a mine, first paint around the filling hole cover and the spoiler, both outside and inside the spoiler. Then paint the entire mine. This procedures eliminates a lot of touching-up later.

COMMON SPRAY PAINT DEFECTS.— The most common defects in sprayed paint are orange peel, runs and sags, pinholes, blushing, peeling, and bleeding.

● *Orange peel* is the general term used to describe a dry painted surface that has a pebbled texture resembling an orange peel. It can be caused by the improper use of thinners, a spray that is not fine enough, too much or too little distance between the gun and the surface, improper mixing of materials, drafts, or low humidity.

● *Runs and sags* are usually the result of paint that is too thin. They can also result when too much material is sprayed on the surface, the spraying stroke overlap is too great, improper adjustments of the spray gun and pressure are being used, or dirty or partially clogged air or fluid passages cause uneven distribution.

● *Pinholes* can be caused by water or excessive thinner in the paint. Excessively heavy applications of quick-drying paint also cause pinholes. In either case, small bubbles form and break when the paint is drying, leaving small holes.

● *Blushing* resembles powdering of the paint. The cellulose material in the paint separates from the solvent and returns to its original powder form. Water is usually the cause of blushing, either moisture on the surface to be sprayed or excessive moisture in the air. To correct a blushing defect, remove the defective coat, because the moisture is trapped in the material and remains there unless the material is removed. Then repaint the area.

● *Peeling* is usually caused by carelessness in cleaning the surface to be painted. Before paint spraying is attempted, the surface to be painted must be thoroughly cleaned. Cheap spray materials sometimes result in poor adhesion, but this should be no problem when standard Navy paints are used.

● *Bleeding* occurs when the chemical compounds of a previous coat discolor the finish coat. When a paint contains a strong aniline dye (a synthetic organic dye), bleeding results when another color is sprayed over it.

SPRAY GUN CARE.— Spray guns (including paint containers and hoses) must be cleaned thoroughly after each use. When using solvent in cleaning spray guns, be extremely cautious because possible damage may occur to the packing around the valves. To clean a container-type gun, refer to figure 1-26 and follow these procedures:

1. Remove the container from the gun.
2. Hold a cloth over the air cap and pull the trigger.
3. Empty the container.
4. Pour in a small amount of solvent.
5. Attach the container to the gun and spray the solvent through the gun to clean out the passageways.
6. Soak the air cap in cleaning solvent.
7. Replace the air cap.

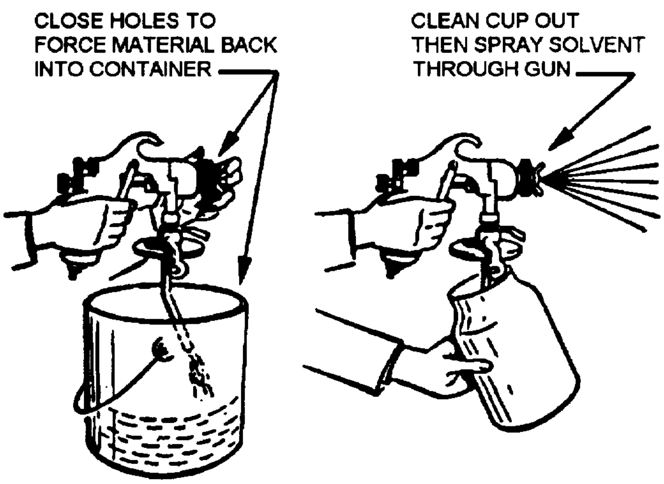


Figure 1-26.—Steps in cleaning a container-type gun.

Some spray gun troubles, possible causes, and remedies are listed in table 1-2.

Spray Gun Lubrication.— A spray gun needs occasional lubrication. To do this, remove the fluid needle packing and soften it with oil. Coat the fluid needle spring with grease or petrolatum. Figure 1-27 shows the location of these parts and the oil hole where you place a few drops of light oil.

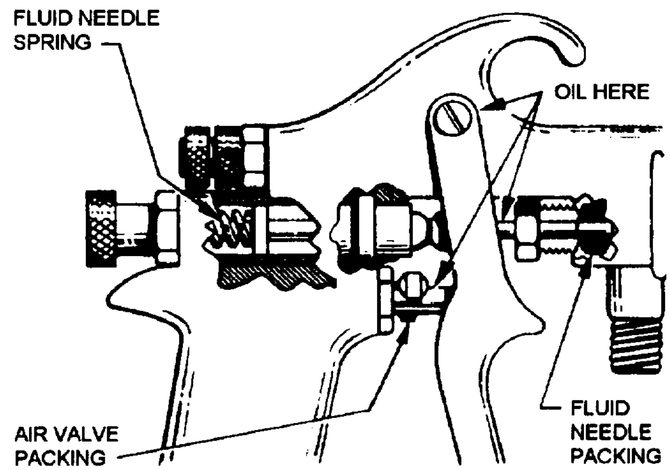


Figure 1-27.—Lubrication points of a spray gun.

Spray Head Removal.— Removal of the spray head may be necessary for cleaning or repair. You may need to change the head when the color of the paint is changed. With modern spray guns, this is a fairly simple operation. Refer to figure 1-28 and follow the procedures in table 1-3.

AIRLESS SPRAY PAINTING.— Airless spray painting uses hydraulic pressure. The equipment is similar to conventional spray equipment except that the pressure is generated by a hydraulic pump. Atomization of the paint is accomplished by forcing it through a special-shaped orifice at a pressure up to 3,000 pounds psi. This pressure allows you to apply paint to the surface as rapidly as you can move the gun.

Airless spray painting usually permits the use of products with a higher viscosity. Less thinning is required, a better film is obtained, and production is increased. A single hose leading to the gun makes it easier to handle and causes less tiring to the painter. The lack of overspray offers two other advantages: cleanup is easier, and masking is minimized.

Because of the high pressure in an airless spray gun, you must ensure that your personnel receive complete instructions on the proper use of airless spray equipment before they are allowed to operate the equipment or to assist in its operation. Training must stress the potential dangers associated with the handling of airless spray paint

Table 1-2.—Spray Gun Troubles, Possible Causes, and Remedies

TROUBLES	POSSIBLE CAUSES	REMEDIES
Air leaks from front of gun	Foreign matter on valve seat Worn/damaged valve seat Sticking valve stem Bent valve stem Loose packing nut	Clean Replace Lubricate Replace Adjust
Fluid leaks from front of gun	Worn/damaged fluid tip/needle Foreign matter in fluid tip Packing nut too tight Wrong size needle	Replace Clean Adjust Replace
Jerky or fluttering spray (suction and pressure feed)	Innsuficient material in container Tipping container to excessive angle Obstructed fluid passageway Loose/cracked fluid tube Loose fluid tip Damaged tip seat	Refill Take greater care Clean Tighten/replace Tighten/replace Tighten/replace
Jerky or fluttering spray (suction feed only)	Material too heavy Clogged air vent in container lid Loose/damaged coupling nut/cup lid Fluid tube resting on bottom	Change to pressure feed Clean Tighten/replace Use proper fluid tube
Defective spray pattern	Air cap horn holes partially plugged Dirt on air cap/fluid nozzle	Rotate air cap 1/2 turn and spray another pattern. If defect is inverted, fault is on/in air cap. If pattern is same, fault is on/in fluid nozzle. Clean proper part.

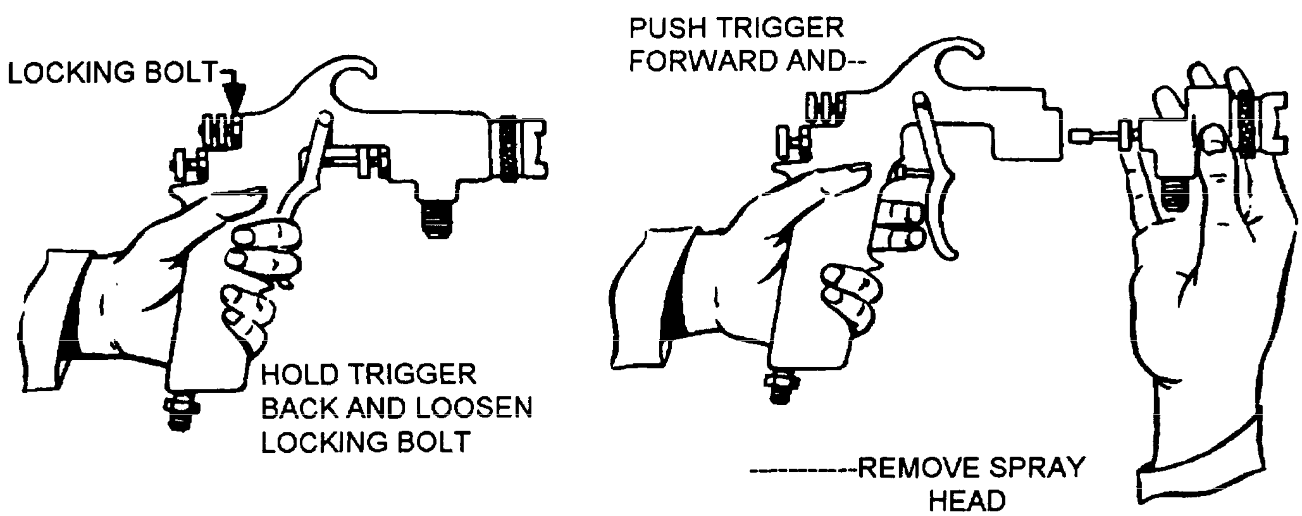


Figure 1-28.—Removing the spray head.

Table 1-3.—Spray Head Removal and Replacement Procedures

STEP	REMOVAL PROCEDURES	REPLACEMENT PROCEDURES
1	Remove the gun from the air hose line.	Push the trigger forward.
2	Hold the gun in your left hand and pull the trigger all the way back.	Insert the spray head.
3	Loosen the locking bolt with the wrench provided for that purpose.	Hold the trigger back.
4	Push the trigger forward as far as possible.	Tighten the locking bolt.
5	Pull the spray head forward.	

equipment. Although safety features designed to minimize those dangers have been built in, amputations and deaths have resulted from careless use of this equipment, particularly when the spray tips were removed for cleaning. Before a spray tip is removed or adjusted, or when spray operations are shutdown for an extended period, turn the electrical power OFF and depress the gun trigger to bleed the line pressure.

Refer to the operator's manual supplied with each airless spray gun for the safety precautions peculiar to that model of gun. The following list of safety precautions must be observed when any airless spray gun is being used:

1. NEVER use airless equipment unless you are fully trained to do so.
2. NEVER allow an untrained person to use the equipment.
3. NEVER put your hands or fingers in front of the nozzle.
4. NEVER point the gun at a person.
5. NEVER work on or repair pressurized equipment. (The equipment must be turned OFF, the pressure released, and the trigger safety engaged before being disassembled. TURNING OFF THE POWER DOES NOT RELEASE THE PRESSURE.)
6. NEVER spray a flammable solvent through the gun tip. (The high velocity generates static electricity, which could cause a fire or an explosion.)
7. NEVER plug leaks with fingers. Before use, check hoses for leaks, cuts, and wear. Replace any damaged hose.
8. NEVER leave a pressurized airless spray unit unattended.
9. ALWAYS secure connections to prevent leaks.
10. ALWAYS use personal protective equipment when using the spray gun. (Wear a supplied-air or organic vapor cartridge respirator with pre-filters, goggles, chemical protective gloves, coveralls, and hearing protection.)
11. ALWAYS use the trigger lock when not actually spray painting (i.e., before wiping the tip). (Remove the tip guard only if spraying with it in place is impossible.)
12. ALWAYS remove the gun from the hose after flushing and when storing it.

13. ALWAYS keep the trigger satlety engaged when the gun is not in use.

14. ALWAYS obtain immediate medical attention for injuries. (Report the nature of the injury and the type of fluid or solvent used.)

MATERIALS NOT TO BE USED IN SPRAY GUNS.— As a general rule, Navy paints, enamels, lacquers, synthetics, varnishes, and shellacs may be used in ordinary spray guns. Material containing small gritty particles, such as alkaline coverings, rubber hose paints, plastics, and mastic paints, must NEVER be used in standard spray guns.

Paintbrushes

Paintbrushes are only as good as the care given them. The best paintbrush can be ruined very quickly if not properly cared for. By following the suggestions given in the next few paragraphs, you will find that your paintbrushes will last much longer and will give you better service.

When paintbrush bristles were set in wood, painters would dampen the wood to cause it to swell and hold the bristles more tightly. However, nearly all modern paintbrushes have bristles set in rubber or in a composition material. Therefore, to wet the end of the handle that holds the bristles serves no useful purpose; in fact, it only damages the brush since it tends to rust the metal band (ferrule).

To make a new natural bristle brush more flexible and easier to clean, rinse it in paint thinner and soak it in boiled linseed oil for about 48 hours. Before using the brush, drain the oil from it, wipe its bristles clean, and wash it in a solvent or other oil remover, (Synthetic bristle brushes do not require special treatment before use.)

Every paint locker should have a container with divided compartments for stowing brushes that are used for short periods with different materials, such as paint, varnish and shellac. The containers should have tight covers and a means of hanging the brushes so the entire length of the bristles and the lower part of the ferrule are covered by the paint thinner or linseed oil in the container. The bristles must not touch the bottom of the container or they could become damaged. A paintbrush with distorted bristles is a very inefficient tool.

When brushes are to be used the following day, they should be cleaned with the proper paint thinner and hung in an empty compartment in the container. Brushes that are not to be used soon should be cleaned in thinner, washed in soap (or detergent) and water, rinsed thoroughly in freshwater, and hung to dry. After drying they should be wrapped in paper and stowed flat. Brushes should not be left soaking in water; the water will cause the bristles to separate into bunches or become flared or bushy.

Remember: After using a brush, NEVER leave it in an open can of paint or exposed to the air. Clean the brush immediately after it is used, then stow it properly.

The proper cleaners for brushes used with different materials are listed in table 1-4.

Table 1-4.—Proper Cleaners for Paint Brushes

MATERIALS USED	CLEANERS
Natural and synthetic oil-based paints and varnishes	Paint thinners or mineral spirits
Latex emulsion	Water
Shellac	Alcohol
Lacquer	Lacquer thinner

Paint Rollers

Paint rollers are designed to apply a uniform coat of paint over a large area quickly, with less effort than with a brush. Paint rollers used in the Navy consist of replaceable, knotted fabric rollers with solvent-resistant paper cores. The roller is supported on corrosion-resistant steel that rotates on a metal shaft.

After use, the fabric cylinder should be stripped from the core, cleaned in the solvent recommended for the paint used, washed in soap and water, rinsed thoroughly, and replaced on the core to dry. Combing the pile of the fabric while it is damp prevents matting.

PAINT COMPOSITION

Paint consists of four essential ingredients: pigment, vehicle, drier, and thinner. The pigment is grounded into the vehicle and the drier and the thinner are added. This section describes these four elements.

Pigment

Pigment is used to give color to the paint. Some pigments also increase the quality of the paint. Inert pigments are chemically stable and do not affect color or destroy the life of the paint vehicle. They are used to provide a less-expensive base for certain kinds of paint colors, to decrease the amount of active pigment in the paint, and to help prevent settling and caking of the pigment in the container. Some common inert pigments presently in use are barium sulfate, calcium carbonate, whiting, magnesium silicate, talc, and silica.

Vehicle

The vehicle, usually referred to as the *base,* is the liquid portion of the paint that acts as the binder and the brushing medium for the pigment particles. The base wets the surface to be painted, penetrates into the pores, and ensures proper adhesion of the film formed by the drying vehicle.

Until recently, the base of most paints was an oil, such as linseed oil. Today, only a few Navy paints contain raw oil. The base of some Navy paints is processed oil in combination with a synthetic resin. Other paints have a vinyl base and some have a water base.

Most oil-based vehicles dry partially by evaporation partially by oxidation, and partially by polymerization. Polymerization is the process where two or more similar molecules combine chemically to forma larger molecule of a new substance. Older paints contained raw oils, had poor physical properties when dry, and dried slower than modern paints. For these reasons, raw oils should NEVER be added to a Navy paint. If the paint is thick and needs to be thinned, add only a recommended thinner. Never add diesel oil, varnish or other nonrecommended material.

Driers

When mixed with oil, certain metallic compounds add to the drying properties of the paint. They are driers and, as used in the Navy, consist chiefly of compounds of cobalt naphthenates.

A paint drier acts as a conveyor of oxygen. It takes the oxygen from the air and adds it to the oil. This process speeds the oxidation of the paint. Without the drier, absorption of oxygen would be too slow, and it would take too long for the paint to dry.

Thinners

Thinners reduce the consistency of paint to the proper degree for application by spraying, brushing, or rolling. Thinners also increase the penetration of paint into the surface being painted and they cut down on gloss. Too much thinner, however, dilutes the vehicle too much. As mentioned earlier, the vehicle is a binder; if it is diluted excessively, the durability of the paint is affected. In flat paints, the proportion of the oil is deliberately reduced by thinners to cause the paint to dry without gloss.

PAINT PREPARATION

No matter how high the quality of the paint, it will give poor service if it is not thoroughly mixed before it is applied. When paint stands for a long period of time, the pigment settles to the bottom of the container and the vehicle rises to the top. Subsequently, the paint must be remixed before use.

If you do not have a mechanical mixer, the best system for mixing is to pour off most of the vehicle into an empty can and mix the remainder thoroughly. Then add a small amount of the remaining liquid at a time until all the vehicle has been added and the consistency of the paint is uniform. To ensure that the paint is thoroughly mixed, pour the paint back and forth a number of times between two cans. This process is known as *boxing* and ensures a smooth and even mixture.

PAINT APPLICATION

Smooth and even painting depends as much on the method of application as it does on the quality of the paint. Different painting equipment (such as spray guns, brushes, or rollers) is used for different purposes. Ensure that you use the right equipment and that it is kept in good condition,

When you are painting, keep the following items in mind:

- The thickness of the coats can determine if the job is completed satisfactorily. Thick coats of paint tend to crack and peel. They are likely to be uneven and they tend to show marks and scratches more readily than thin coats. They do not dry as hard a finish as thin coats. For a complete list of the paint systems applicable to mines, refer to NAVSEA SW550-AA-MMI-010.

- Painting should not be done when the temperature is below 32 °F. In cold weather, moisture condenses on the surfaces and the paint does not stick. Also, the thinner evaporates very slowly and increases the drying time, For best results, painting should be done in warm weather, with the temperature between 60 °F and 80 °F.

- Humidity and ventilation are also important conditions. Excess humidity may cause condensation on the surface to be painted, making painting difficult. But humidity can be reduced by proper ventilation. Proper ventilation is necessary to furnish the oxygen necessary to dry the paint properly.

Striping

You may be required to apply stripes to a painted surface or to an unpainted surface. Striping is relatively easy if you use masking tape. But after painting, be careful when removing the masking tape. Pull the tape off in a diagonal direction and back upon itself If you fail to remove the tape in this manner, you may damage the finished painted surface. The procedure is a little different for each situation.

STRIPING PAINTED SURFACES.— Use the following procedures to stripe painted surfaces:

1. Decide the size and the position of the stripe.

2. Apply masking tape firmly to each side of the area where the stripe is to be.

3. Paint the areas not covered by the masking tape.

4. Protect the painted surface against daubs and oversprays by using protective covering in addition to the masking tape.

STRIPING UNPAINTED SURFACES.—Use these procedures to stripe unpainted surfaces:

1. Paint the stripe wider than the actual stripe is to be.

2. After the paint is dry, apply masking tape to the area where the stripe is to be. To ensure that the tape is smooth and firmly attached, rub or roll it.

3. Paint the entire surface, including the masking tape, with the finish coat.

4. After the paint is dry, remove the tape.

PAINTING SAFETY

For a safe painting operation, responsibility and training are the two most important factors. The importance of these factors must be clearly understood by all personnel associated with the painting operation.

Personnel concerned with the painting operation must also be made aware of the hazards associated with the handling and use of flammable materials and with applicable safety precautions. This information must be a part of each person's job training.

Every painting operation exposes the personnel in the immediate area to some conditions and situations that are actually or potentially dangerous. The use of toxic and flammable materials and pressurized equipment presents potential hazards. Hazards may also be inherent in the working conditions or may be caused by inexperience of the operator, lack of training, or just pure carelessness.

Therefore, awareness of all potential hazards is essential, To minimize existing hazards and to improve the efficiency of the painting crew, ensure that your personnel are so well-trained that they automatically take precautionary measures.

Safety Practices

When planning painting operations, pay special attention to the following factors:

1. Paint materials

2. Surface preparation materials

3. Painting equipment

4. Environment

5. Experience of the painting crew

6. Degree of hazards

Remember that CARELESSNESS increases hazards. Shortcuts often produce unsafe working conditions, resulting in accidents, personnel injuries, and loss of time and materials. An element of risk is still present even when well-trained personnel follow prescribed safety procedures. However, if safety precautions are carefully observed at all times, the risk of accidents will be minimal.

Spray-painting equipment has been known to produce several thousand volts of static electricity. For this reason, the spray gun nozzle and any explosive items being painted must be grounded to the same point during the spray-painting operation. When high-voltage spray-painting equipment is used or installed, it must be done so in accordance with the National Electrical Code.

The application of paints, varnishes, lacquers, and enamels by the spraying process is more hazardous than the application by brush for several reasons:

1. There is a greater volume and concentration of work.

2. Spraying produces a residue of flammable properties subject to spontaneous ignition.

3. Health hazards may exist because of potentially harmful substances that maybe present (such as lead, benzol, and silicone). Therefore, all safety precautions must be strictly observed. Personnel must continuously observe good habits of personal hygiene to avoid the health hazard of lead poisoning. Any person with a histoty of chronic skin disease, allergies, or respiratory problems must not be permitted to work with paint compounds and thinners. Personnel handling painting materials must prevent the materials from coming in contact with their skin or eyes and must avoid inhaling the mist or vapors. A spray painter must wear gloves and protective garments that fit snugly at the ankles, the neck, and the wrists. All exposed areas of the painter's skin should be covered with a protective cream.

Respirators

Spray-painting guns break up the paint into a fine mist of paint pigments and vehicle or solvent vapors, The vapors and pigment can be health hazardous if you inhale them or allow them to contact your skin. Unless the spray area is equipped with local exhaust ventilation and tested for efficiency, personnel must wear respiratory protection.

An industrial hygiene survey of the ventilation system will determine if personnel need respirators and the type required. Respirator users must be medically screened and fit-tested to the respirator they will use according to the *NAVOSH Program Manual,* OPNAVINST 5100.23, or the *NAVOSH Program Manual for Forces Afloat,* OPNAVINST 5100.19.

There are two types of respirators: air-purifying and supplied air. The correct respirator must be selected for the hazard.

1. Air-purifying respirators: Air-purifying respirators have filters or cartridges to trap or absorb air contaminants. For spray painting, personnel must be protected against the organic vapors of the paint vehicle, or solvent, and against the pigment mist. This requires an organic vapor cartridge with a mist pre-filter over the cartridge. The cartridge and the pre-fiber attach to either a full-facepiece or half-facepiece respirator mask. See figure 1-29. For sanding operations, a cartridge rated as protection against dust is substituted on the mask. See figure 1-30.

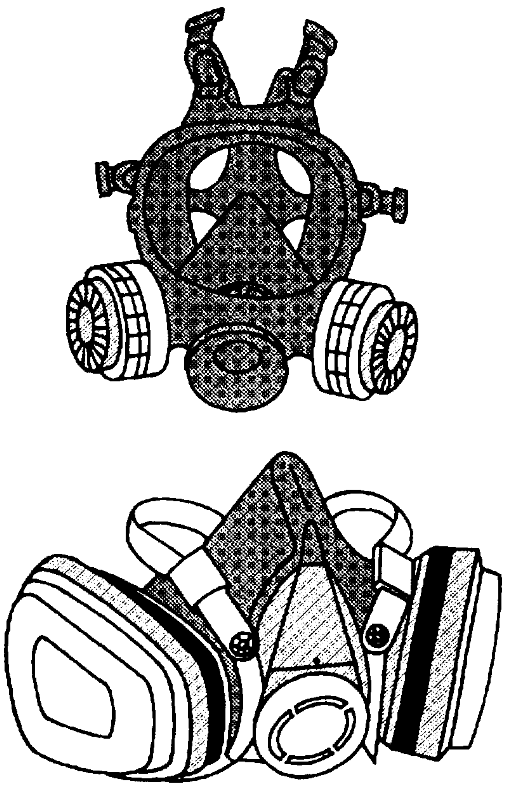


Figure 1-29.—Full-facepiece and half-facepiece cartridge respirators with pre-filters.

2. Supplied-air respirators: Supplied-air respirators are used when there is an oxygen deficiency or the concentration of air contamination is too high to use air-purifying respirators. They are used when the air contaminant has no warning properties (such as smell) to alert the wearer of exposure to the hazard. The air is supplied to a hose-line mask, through an air compressor, a breathing air pump, or a self-contained breathing apparatus (SCBA). See figure 1-31. If a breathing air pump or a compressor supplies the air, the air must be tested and certified for breathing.

Figure 1-30.—Dust respirator.

a. Sandblasting and spray painting hoods are a type of supplied-air respirators. The hood fits over the entire head and neck and air flows into the hood continuously. This provides a positive pressure inside the hood, preventing intrusion of air contamination. Air-supplied hoods provide eye protection and do not require fit-testing.

Figure 1-31.—Supplied-air respirator hose-line mask.

b. Sandblasting hoods are usually made of leather or heavy material to resist deterioration from the abrasive sand. Spray painting hoods may be made of disposable, paper-like material with replaceable, peel-off window covers. See figure 1-32.

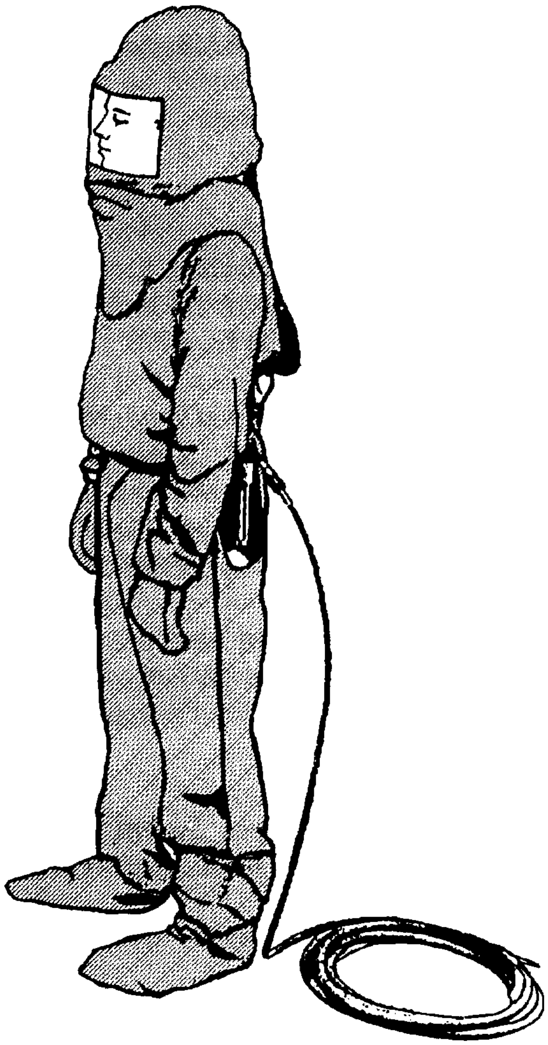


Figure 1-32.—Disposable spray-painting hood.

BATTERY REFRIGERATOR STORAGE

Electrical energy for U. S. Navy mines is supplied by dry-cell batteries, which comprise a variety of chemicals in different combinations. These dry-cell batteries have a fixed shelf life when stored within a specified temperature range.

For Leclanche, alkaline, and mercury cells, the specified range is 56 °F to 80 °F. For cadmium-mercury cells, the specified range is 21 °F to 95 °F. At these ranges, batteries deteriorate at a normal rate. At temperatures above these ranges, batteries deteriorate at a rate faster than normal. Conversely, they deteriorate at a rate slower than normal at temperatures below these ranges.

An exception to these temperature requirements is the Mk 131 battery which, until activated, is stored in ordinary ambient temperatures. Once the Mk 131 battery is activated, it must be placed in refrigerated storage with temperate ranges for mercury cells.

Batteries should be stored at the lowest possible temperature, but not below the minimum limits listed in NAVSEA SW550-AA-MMI-010 or the batteries could be damaged. For optimum service, store batteries at the nominal temperatures listed in the above publication.

Although manufacturers package batteries in special packing, batteries are fragile and must be handled with care, regardless of the temperature at which they are stored or shipped. Batteries frozen to 30 °F are brittle and handling should be minimum.

Batteries should be stored separately by type and lot and, where possible, arranged so that the older batteries can be removed without disturbing the newer lot. Where space permits, stacks should be kept small to allow easy handling. Generally, it is preferable to leave an air space along the walls and at the top and bottom of the chamber, with several aisles through the central area. The size of the space is dependent on the location and capacity of the circulating fan. Stacking in front of the entrance to a vestibule can aid in temperature maintenance within the refrigerator, particularly during receipt and issue.

Battery Thawing

Depending on operational requirements, batteries may be thawed by using any one of three methods: normal thaw, standard rapid thaw, or alternate rapid thaw.

1. Normal thaw procedure: Time permitting, the normal thaw procedure is preferable and should be used because handling is kept to a minimum and the batteries do not accumulate moisture since they are not removed

from their containers. It requires from 24 to 48 hours to reach a point where the battery temperature is high enough to permit testing.

2. Standard rapid thaw procedure: The batteries are removed from their containers and polyethylene bags, freeing the batteries from all packaging. This procedure is commonly referred to as *preferred rapid thaw procedure.*

3. Alternate rapid thaw procedure: The batteries are removed from their outer containers, but not from their polyethylene bags, This method allows the batteries to remain relatively dry since the water condensation forms outside the polyethylene bag and not on the battery.

Immediately after thawing the batteries, they may be tested without damage. However, batteries could fail class-B testing at this time solely because their internal temperature is too low. Batteries failing this test should be set aside for an additional 24 hours and retested.

Anytime a battery is thawed from a frozen state, a minimum of 2 months should be added to the effective storage time on the battery history card. If the battery remains thawed for more than 2 months, the time added to the battery history card should be the actual time, multiplied by the appropriate factor from the effective storage time factors in NAVSEA SW550-AA-MMI-010.

For further information on battery storage, battery thaw procedures, and battery effective storage time, refer to NAVSEA SW550-AA-MMI-010.

RECOMMENDED READING LIST

NOTE: Although the following references were current when this TRAMAN was published, their continued currency cannot be assured. Therefore, you need to ensure that you are studying the latest revision.

Ammunition and Explosives Ashore, Safety Regulations for Handling, Storing, Production, Renovation, and Shipping, NAVSEA OP 5, Vol. 1, Naval Sea Systems Command, Washington, D.C., 1990.

Handling, Packaging, Storing, and Transportation of Underwater Mines and Destructors for Shore-Based/Shipboard Operations, NAVSEA SW023-AB-WHS-010, Naval Sea Systems Command, Washington, D.C., 1990.

Mine Components A through C; Description and Class-B Criteria, NAVSEA SW550-AA-MMI-010, Naval Sea Systems Command, Washington, D.C., 1988.

Underwater Mine Maintenance System, NAVSEA SW550-FO-PMS-010, Naval Sea Systems Command Washington, D.C., 1990.