CHAPTER 8

AMMUNITION AND MAGAZINES

INTRODUCTION

The preceding course in this series, *Gunner's Mate M (Missiles) 3 & 2*, NAVTRA 10199 gave you basic information on explosives their nature, history, classification, characteristics, and service use, along with some definitions of terms used in relation to explosives. Nearly every part of a missile round contains one or more types of explosives, selected to produce the desired effect. A fuze must contain sensitive explosives, yet not so sensitive that it cannot be handled (carefully) with safety. Boosters contain propellant charges that produce a steady thrust. Warheads contain high explosives for quick and devastating detonation.

The use of a special pyrotechnic item - the flash signal on exercise heads - and the purpose of self-destruct devices in missiles, were explained briefly in the above text.

The payload of a missile is in the warhead. The above text also described the different types of warheads that might be used in missiles. Advantages of certain types were given. Advances in the construction of shaped charges have increased their destructiveness. The continuous-rod type of warhead is used in some terrier, Talos, and Tartar missile warheads.

Nuclear warheads can be used in certain mods of Terrier and Talos missiles, Details of nuclear warhead construction are beyond the security classification of this course, but information on the destructive effects of nuclear weapons is available in unclassified publications. You are not required to know the scientific explanation of how nuclear reactions occur, but because some missiles are stowed with the nuclear warhead installed, you should know how to handle and stow them so there won't be an accidental reaction. A nuclear warhead also contains a considerable quantity of conventional explosives, usually several kinds which include both fast-burning and slow-burning propellants and high explosives. The safety rules for explosives therefore apply also to nuclear missiles.

All the current missiles fired from shipboard launching systems use solid propellants of the fast-burning type for boosters. Slow-burning propellants are used for the sustainers, which continue to accelerate the missiles after booster burnout. The Tartar has both the booster and sustainer in a single-stage dual-thrust rocket motor (DTRM). The Talos is the only one with a liquid fuel sustainer. It has a ramjet engine that uses JP-5 jet fuel (kerosene). The ramjet engine takes over after the booster has burned out and dropped off.

This chapter will go into more detail on the tests and inspections to be made of missiles and missile components before stowage, during stowage, and just before use. Since GMMs are now responsible for the nuclear warheads installed in their missiles, your duties and responsibilities with regard to the nuclear components will be expanded upon. You will have more responsibility for reports on tests, condition of missiles and missile components, and accounting for quantities on hand or parts needed. This chapter will give you information on reports needed.

On shipboard, your missile stowage spaces are well regulated and protected. At shore stations, the situation may be far different, especially at advanced bases. Your quals require you to know how to stow missiles at shore bases. Chapter 2 gave you some information on the subject of

stowage at shore bases, and chapter 11 will tell you where to find additional information. This chapter makes only brief references to the subject. OP5, Volume 1, Ammunition and Explosives Ashore, is a compendium of rules for depot or other shore station ammunition regulations. Be sure to study the latest revision.

SAFETY OBLIGATIONS

Supervisory personnel are responsible for ensuring that all safety precautions related to handling, stowage, and use of all types of ammunition and explosive ordnance with which a vessel is supplied are strictly observed in all handling and stowage areas under their cognizance.

Explosives are intended to be destructive. While some are more dangerous than others, all explosives must be treated with respect. Since familiarity with any work, no matter how dangerous, is apt to lead to carelessness, all personnel who supervise work in connection with the inspection and use of explosives shall:

1. Exercise the utmost care that all regulations and instructions are observed.
2. Carefully instruct those under them and frequently warn them of the necessity of using the utmost care in the performance of their work. No relaxation of vigilance should be permitted.
3. Explain to their subordinates the characteristics of the ammunition, explosives, and other dangerous materials; the equipment, the precautions to be observed; and the hazards of fire, explosion, and other catastrophes which the safety precautions are intended to prevent.

Supervisors are required to maintain high standards of good housekeeping in ordnance spaces. Everything that is not in its place or is not in the safest condition increases the probability of an accident. All ammunition, missiles and their complementary items shall be protected from extremes of temperature, humidity, vibration, electromagnetic or magnetic fields, and radiological exposure. Observe the permissible maximum stowage temperatures for all ordnance as prescribed by NAVORDSYSCOM. Moisture and heat may cause some explosives to deteriorate and become dangerous.

In each weapon space where missiles are stored or handled or where missile equipment is operated, such safety orders as apply should be posted in conspicuous places. Conditions not covered by these safety instructions may arise which, in the opinion of the supervisor, may render missile stowage or missile handling unsafe. The supervisor may at any time use such additional safety instructions as he may deem necessary.

RF RADIATION

The most sensitive explosives are used in fuzes and igniters. Electric igniters, VT fuzes, detonators, and electrically fired rocket motors must be protected from radiofrequency emissions. None of these units may be exposed within 10 feet of any operating electronic transmitting equipment, including antennas and antenna leads. The minimum distance varies with the power output of the transmitters. Warning signs are required to be posted at the foot of all ladders or other access to all towers, masts, and superstructures which are subjected to hazardous levels of radiation, and also in the radio transmitter room. If the transmitting apparatus is part of authorized test equipment, or is part of the weapons system, follow the special instructions concerning its operation.

Naval Ordnance Systems Command carries on the Hazards of Electromagnetic Radiation to Ordnance (HERO) program to promote the safety of our weapons against rf radiation. The broader program, under the direction of the Chief of Naval Operations, has the code name RAD HAZ. It investigates the effects of electromagnetic radiation on ordnance, personnel, and volatile flammable materials. Protection of personnel against such radiation is now required on all ships. RF radiation causes damage to body tissue, which becomes heated by absorbing wave energy. The damage may be done before you feel any sensation of heat. The harmful effects may result from irradiation of the whole body, of the eyes, or of the reproductive organs. Eye damage is the most frequently noted health hazard. Do not permit your men to work where they can be harmed by rf radiation.

Technical Manual, Radio Frequency Hazards to Ordnance, Personnel, and Fuel, OP 3565, is the official HERO publication. It prescribes the operating procedures and precautions to avoid rf

radiation damage to ordnance, personnel., and fuels. This manual supersedes all previous publications on rf hazards, and parts of manuals or publications dealing with this hazard, including NAVSHIPS and NAVORD publications. Many tests were conducted to determine for each weapon and/or component if it was HERO Safe, HERO Unsafe, or HERO Susceptible ordnance. The situation also makes a difference. RF radiation is most likely to damage ordnance during assembly, disassembly, loading or unloading, and handling in rf electromagnetic fields. The rf energy may enter through a hole or crack in the ordnance item, through firing leads, wires, contact with metal of tools or handling equipment, or exposed wires or contacts. A wooden or a plastic container is no protection against rf energy. Metal enclosures serve as a shield.

The technical manual cited above contains lists of explosive items and missile components that are HERO Safe, HERO Susceptible, and HERO Unsafe. However, items that are HERO Safe when completely assembled may be HERO Unsafe when tests are being conducted that require additional electrical connections, or when being assembled or disassembled, or when in a disassembled condition. Any time there are exposed wire leads from electroexplosive devices such as squibs, primers, and blasting caps, or unshielded flash signals, igniters, tracking flares, etc., there is a HERO Unsafe condition. Unshielded rocket motors, warheads, and exercise heads are HERO Unsafe. HERO Unsafe ordnance must not be permitted on flight or weather decks at any time. Testing, assembly, and disassembly of ordnance should be done below decks if at all possible. When it must be done on deck, be sure that all radiation equipment is secured.

Each ship should prepare a HERO Bill based on the information contained in OP 3565, just as each ship has a FIRE Bill. This would coordinate radar and radio control with the work being done in the ordnance department. Preparing the bill is the responsibility of the Commanding Officer who may designate a HERO officer. The great increase in the use of electronic equipment and the increase in transmitter output powers has brought an equivalent increase in the amount of radiation. The use of guidance radars brings more radiation to deck areas. It is only in recent years that the hazards have been investigated. The cause of many formerly unexplained explosions and duds was revealed to be from electromagnetic radiation.

SAFETY CHECKS

Before handling any component containing explosives, inspect the safety device to be sure it is in the SAFE position. If it is not, the unit must be made safe by experienced personnel. In most instances, the "experienced personnel" means you.

Be sure the airframe of the missile is well grounded electrically at all times. Check the grounding when the missile or a component is on the elevator, transfer cart, or other handling equipment during replenishment, stowage, inspection, mating, or unmating. The checkoff sheets for each operation list grounding as one of the steps (remember this when you prepare checkoff sheets); check each ground for correctness and firmness of attachment before you let your men proceed with the operation.

Be sure that the rocket motor case is grounded during all handling operations. Before connecting igniters in rocket motors, check firing leads for stray or induced voltages and for static charges. Inspect the igniter to see that the case and safety switch are not damaged. Any damage on these items is cause for rejection.

SPECIAL DANGERS OF DIFFERENT EXPLOSIVES

Black powder has been called the most dangerous of all explosives. It must be protected against heat, moisture, sparks, rf radiation, and friction. Only very small quantities are used in modern naval ordnance in fuzes, igniters, tracking flares, and primers. Largest quantities are contained in impulse charges.

The cast propellants used in rocket motors and sustainers must be protected against heat, moisture, and physical damage from dropping, abrading, etc. A crack in the cast propellant can cause failure of the missile because it prevents continuity of the burning rate. Powdered or crumbled propellant is more dangerous than the undamaged material. Dragging boxes over smokeless powder grains or broken propellant

on concrete decks or docks has caused fires. Powder grains that have fallen into cracks and crevices are believed to have been the cause of many fires. The explosive ordnance disposal (EOD) team should be called immediately if powder is spilled or more propellant is broken. Work must be suspended until the spilled or broken explosive has been collected and placed in water-filled containers. Report all accidents or incidents to NAVORDSYCOM according to NAVORDINST 8025.1 (latest revision).

Some of the high explosives used in warheads look very much like harmless chunks of clay or pieces of rock. Scraping, striking, or dropping them can cause them to explode. Some high explosives cause dermatitis when handled with bare hands; some give off poisonous gas when they burn; one type leaves a white, powdery residue that is poisonous; and another type leaves a residue that is explosive if moved even a little. A drop of as little as 5 inches can cause PETN to explode; TETRYL has a drop sensitivity of 12 inches. These are high explosives used in warheads. The EOD team is trained in procedures to follow in emergencies with explosives; untrained personnel should not move damaged explosives.

TNT is now seldom used alone, but it is a major ingredient in several of the high explosives. Heat and sunlight deteriorate and darken it, and cause an exudation that is extremely dangerous if mixed with or absorbed by organic matter, such as wood. Any explosive containing TNT must not be stored on wood or linoleum decks. The exudate may appear as an oil liquid, or it may be sticky and viscous. It may collect in detonator wells on a warhead. Exudates must be. removed as soon as observed at inspection.

TNT is practically insoluble in water; the exudates can be washed off with hot water, this. is the preferred method to be used. NEVER use steel scrapers, soap, lye, or other alkaline solutions to remove exudate. Even a small amount of caustic soda or potash will sensitize the TNT and cause it to explode if heated to 160° F. Carbon tetrachloride, acetone, alcohol, and trichloro-ethylene will dissolve exudate. The first named should not be used because of its toxic fumes; the third named could cause further exudation after a period of time; the last named is the solvent most likely to be available to you. Be sure to have adequate ventilation when using any solvent.

Missile boosters are usually propellants, which tend to burn rather than detonate, though they may detonate if confined during burning. Propellants, jet thrust units, flash powders, and pyrotechnic powders all belong to this fire hazard class.

A rocket motor that has been dropped must not be fired. It must be returned to the depot, or disposed of according to instructions in: the OP or instructions from the commanding officer.

Never use any power tools on the rocket motor. Never apply heat to the motor, or to any of its associated components.

In case of a rocket motor misfire, wait at least 30 minutes, and make sure the firing circuits are open, before you approach the rocket.

Missiles not expended in live runs must be safed at the first opportunity in accordance with the instructions for the missile.

The tracking flares used on exercise heads contain black powder and magnesium, or a mixture of barium nitrate and aluminum. The dangers of black powder have already been mentioned. The magnesium powder is a fire and explosion hazard. In the air, a spark can cause an explosion. In contact with water, magnesium powder can burn violently. Metal fume fever is caused by magnesium oxide. If particles of magnesium get into a wound in the skin, gas gangrene may result. Because of all these hazards, tracking flares and flash signals must be handled with great care. They must be stored in the pyrotechnic locker. Moisture must be kept away from them, as well as heat and sparks. Rough handling, or movement in storage must be avoided. Check all missile electrical connections for NO-VOLTAGE before installation of the flash signal charge in the missile. Figure 8-1 shows a cross sectional view of a flash signal kit.

The self-destruct charge contains Composition B and Tetryl, both of them high explosives, contacted by two explosive leads. The explosive leads are detonated by an electric primer. The primer leads must be shorted at all times until just before firing. Handle and store these charges as high explosives. Always check the visual indicators for SAFE condition of the unit prior to installation.

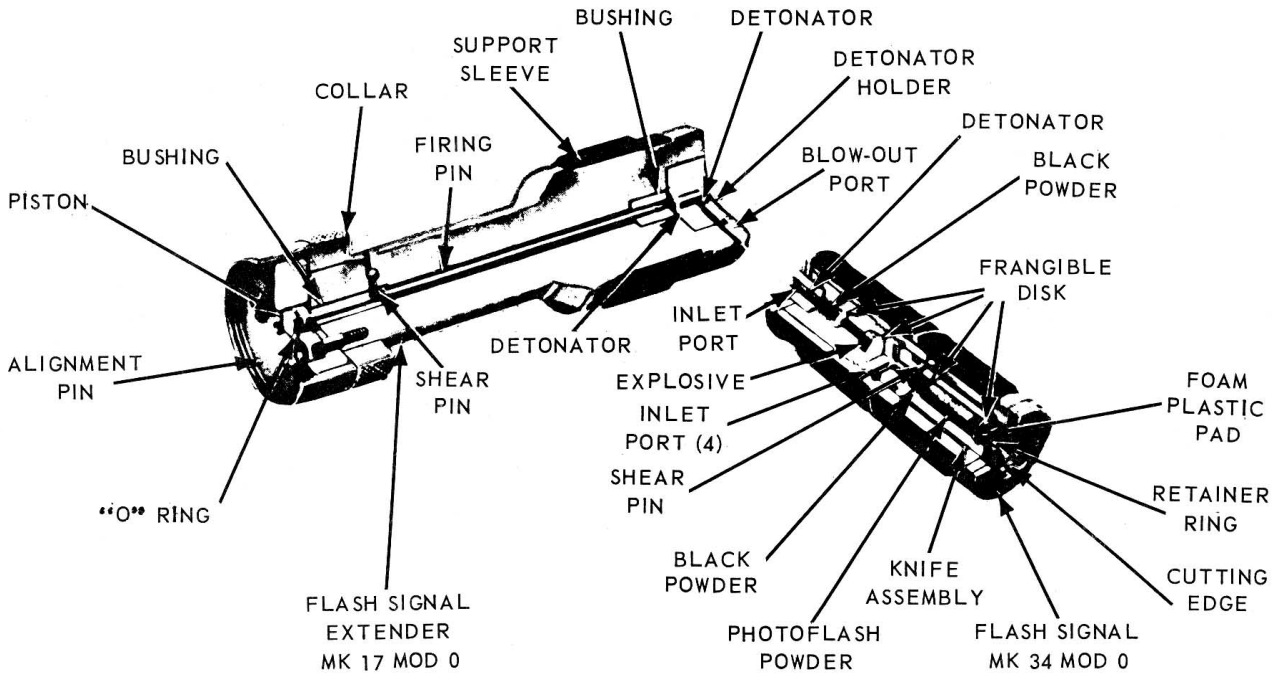

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Figure 8-1.—Flash Signal Kit for Tartar missile exercise head.

NUCLEAR WARHEAD WEAPONS

With the exception of the nuclear hazard, there is little difference between the safety aspects of nuclear weapons and conventional weapons. These are the hazards of high explosives, propellants, detonators, igniters, flash signals, self-destruct devices, arming devices, mechanical and electrical hazards. These components surround the warhead or are attached to it.

The hazard of radioactivity is always present where there is a nuclear warhead. However, the hazard is minimal because of the many safe-guards included in the nuclear warhead. Improper handling can, of course, increase the hazard. As long as the seal of the nuclear container remains unbroken, the radioactive material does not escape. However, if by some mischance, the seal of the nuclear container is broken and finely powdered radioactive material escapes into the air, personnel must immediately evacuate the area. Decontamination teams wearing OBAs are sent to decontaminate the area. The radioactive particles do the most damage inside the body, and they are very easily inhaled or ingested. These tiny particles spread rapidly through the air, and get into all crannies and crevices and settle on everything. If the accident happens while the missile is on the launcher, above decks, much of the radioactive material will be carried away into the atmosphere, but if it occurs in the magazine or other space below decks, the ventilation system would quickly carry the contamination to other parts of the ship. That is why the instructions tell you to hold your breath, turn off the ventilation system, get out of the space, and close it.

If two sub-critical masses of active material from nuclear warheads are brought too close together (less than 3 feet), the entire mass can go critical, and personnel in the vicinity will receive massive does of radiation. When the active material is in the warhead and the warhead is in the missile, the necessary 3-foot spacing is automatically provided.

The greatest danger is probably that of accidental detonation of the explosives in the warhead, which could result in a partial nuclear detonation. (It is believed that an accidental full-scale nuclear detonation is an impossibility.) Even if only one detonator is exploded, some nuclear material may be spread in the vicinity of the detonation. Therefore, extreme care must be

used not to activate any fuzing or firing device. Take care not to subject detonators to undue bending or twisting, and NEVER drop them. The nuclear material may burn, spreading contamination in the immediate vicinity. In a nuclear accident, the radiation resulting is the same as from a nuclear warshot. In a partial detonation, the noticeable effect may be so slight (just a puff) that it is overlooked, but the deadly radiation is present just the same. Any personnel in the area must report to the medical department. One of the insidious things about nuclear radiation is the fact that you cannot feel it (except massive doses that are quickly fatal). You cannot see it, taste it, smell it, and its deadly results may be long in developing. Though the men may protest that they feel fine, see to it that all the men who were in the area are monitored and report to the medical department. Since there no longer is a requirement for continuous monitoring of weapons spaces on shipboard, the monitoring done by the medical department forms the only record of the radiation.

INSPECTION AND TEST OF EXPLOSIVE COMPONENTS

The testing of explosive components aboard ship is naturally very limited. Explosive items never tested on shipboard are S&A units, fuzes, flash units or tracers, and boosters. The electrical circuits are tested for continuity, but great care must be used to make all connections correctly and not actuate any explosive. The men of the Fire Control Technician (FT) rating are responsible for most of the testing of components of the missile, as well as the functional resting of the weapons system. An FTC acts as the coordinator of weapons system tests. The GMMs position and prepare the missiles for testing. They install or remove adaption kits, arming and fuzing devices, and replace defective or malfunctioning components or modules. They must know the methods of testing missile propellants, boosters, and sustainers. (Note: Boosters are not tested aboard ship.)

INSPECTION

The inspections to be made upon receipt of the missiles and missile components at replenishment were discussed in chapter 2. Missiles are delivered to the firing ship in assembled condition; inspect of the components was performed at the facility that assembled the missile. If the missile is delivered in a container, you inspect it only for evidence of damage from rough handling or water. After unpackaging for stowage (or if it is received in the unpackaged state), you can inspect the exterior more closely for evidence of rough handling, water damage, mildew or other fungus growth, and broken or missing parts. Parts that are unpackaged before stowing, such as wing and fin assemblies, are inspected when unpackaged. Check the position of safety switches to make sure the missile is not armed. Check the humidity indicator if there is one. If the humidity is too high (the OP for the component lists the humidity limits and heat limits), unpackage the component and inspect for damage. Heat damage is seldom visible; the missile's record provides the evidence of over-exposure to heat and cold. Dispose of damaged components as directed by your officer. If the, component is still usable, repackage it with fresh desiccant and packaging materials as necessary. Packaging to make a waterproof container must be done according to precise packaging instructions and with the prescribed materials.

Damaged explosives must be disposed of in accordance with orders. Some have to be packaged carefully and sent back to the facility; others are thrown overboard. Call your officer to decide what is to be done. The quals require a GMMC to know enough about the explosive components to recognize dangerous changes and know what should be done in each condition. See OP 4, Vol. 2, *Ammunition Afloat*, for general rules on disposition of explosives, and the applicable missile OP for specific rules.

Nuclear Warhead Inspection

When a nuclear warhead is received aboard in a container, it is given receipt inspection. The outer container is removed before transfer to the checkout area, where the inner container is removed. Remove the records from the outer container. Inspect the seals, and if there is evidence of tampering, notify the security officer. Check the humidity indicator on the package. If it shows humidity in excess of 40

percent, a thorough check must be made (after you have finished unpacking the warhead) for mildew or other fungus or other evidence of moisture damage. Fungus growth or corrosion can be removed; it is not a cause for rejection of the warhead. Superficial scratches or abrasions on the warhead are not a cause for rejection, but dents or deformation are.

WARNING: If the safety switch actuator is in the ARMED position, rotate it back to SAFE with a large screwdriver. Submit an incident report to NAVORDSYSCOM.

The Battery Power Supply may come packaged separately and may be stowed that way, or an administrative decision may be made to install it in the warhead. A monitor test follows battery installation. The warhead may be placed in temporary storage until it is installed in the missile, or it may be placed in the warhead magazine, encased in the inner container.

When performing any work involving a nuclear warhead, obey the 2-man rule-always have two qualified men present. They must be familiar with the Navy SWOPS that spell out the details of caring for nuclear weapons. Great care must always be used not to bump or drop the warhead. That means all handling equipment must be in safe operating condition, and that you have enough men to do the work safely. Check the operation of the handling equipment before using it.

Storage inspection and monitor tests of stowed nuclear warhead or warheads assembled into the missile are performed according to the Navy SWOP for the missile. For example, Navy SWOP W45.21-1 gives the instructions for Terrier missiles. The frequency of inspection varies for the different warheads the Navy has; but all are given a receipt inspection, an inspection when removed from a missile, and another prior to being offloaded. A defective power supply battery may be removed but no other disassembly of the warhead on shipboard is authorized.

DISPOSAL OF EXPLOSIVES

As has been mentioned several times, you do not jettison a missile unless it is absolutely necessary for the safety of the ship and men. If it is a dud, you return it to the magazine until you can return it to a depot for refurbishing. In case of a misfire in which the APS are expended, the aft section of the missile must be replaced. This is done at a depot. To prevent damage to the roll free gyro, it must be recaged. After waiting the required time (minimum of 15 minutes for Terrier) after the misfire, apply external power for at least one minute to ensure caging of the gyro. Return the missile to the magazine as a dud. Enter the facts in the missile log - that a misfire occurred, that the APS were expended on the launcher, and the condition of the gyro caging mechanism. Shipboard replacement of the APS components is not permitted. Shipboard replacement of aft section components is limited to those items for which spares are provided.

Boosters and Sustainers

Rust and corrosion may be removed from boosters and sustainers with fine sandpaper; but emery cloth or a wire brush should never be used, as they cause static electricity that could fire the igniter. If a booster or a sustainer is dropped, set it aside and notify NAVORDSYSCOM and ask for instructions for its disposition. Boosters and sustainers should be grounded at all times during handling, maintenance, assembly, and disassembly.

Should any indication of abnormal deterioration of boosters or sustainers be noted (such as exudate or excessive corrosion), notify NAVORDSYSCOM promptly.

Other Explosive Missile Components

Other explosive components of missiles are igniters, self-destruct components, safe and arming devices, fuze booster, flash signal charge, APS igniter, APS gas generator, and the warhead. Do not try to clean corrosion from an igniter because static electricity could ignite it. Do not disassemble it. Do not stow it in the vicinity of electrical discharge or radio wave radiations. If an arming device does not function properly, make no attempt to repair it but notify NAVORDSYSCOM of the malfunction.

Any S & A device that has been dropped 5 feet or more (when packaged), or is suspected of having been dropped, should be repacked and instruction for disposition requested from NAVORDSYSCOM. Any unit found in the armed condition must be disposed of in accordance with established procedures and a full report of the incident sent to NAVORDSYSCOM, and the S & A log sheet forwarded to Naval Ordnance Laboratory, Corona, California.

The fuze booster screws on to the aft end of the S &.A device. Do not attempt to clean it and do not test or disassemble it; inspect it for visual damage.

The flash signal used in exercise heads is a pyrotechnic item and must be handled and stowed as such. The destructor charge and the APS igniter are high explosives, and the APS gas generator is classed as a fire hazard. The gases produced are toxic and may be explosive if confined.

MISSILE COMPONENT IDENTIFICATION

Navy guided missiles, as with other ammunition, are classified as service (tactical) missiles and nonservice missiles. Tactical missiles, or rounds, are fully functional and fully explosive loaded rounds. Nonservice missiles may be further segregated into practice (exercise) rounds, training (training or inert operational) rounds, and dummy (dummy or shape) rounds. Each type of nonservice missile carries an identifying ammunition color code.

The external surfaces of all Navy guided missiles (service rounds), except radomes and antenna items, are painted white. White has no identification color coding significance when used on guided missiles. Three significant color coding colors - yellow, brown, and blue - are used on guided missiles and their components. The three colors are applied to the external surface of guided missiles to indicate explosive hazards and uses.

Color Code Interpretation

Yellow identifies high explosives and indicates the presence of an explosive which is either:

(a) sufficient to cause the ammunition to function as a high explosive, or

(b) particularly hazardous to the user.

Brown identifies rocket motors and indicates the presence of an explosive which is either:

(a) sufficient to cause the ammunition to function as a low explosive, or,

(b) particularly hazardous to user.

Light Blue identifies ammunition used for training or firing practice. Blue painted items may have a yellow or brown band painted on them to indicate explosive hazards or may be an overall blue color without bands indicating a training item that is nonexplosive loaded. Any missile with external surfaces painted all blue is a fully inert training item.

Light Green identifies smoke or marker ammunition.

Missile and Component Markings

Guided missiles that contain compressed gas components fitted with an explosive squib are classified, for the purpose of explosive color coding, as being particularly hazardous to the user and are so indicated by a brown band on the component and on the external surface of the missile section in which the gas flask is contained. Figure 8-2 illustrates color coding for a typical missile configuration.

Guided missile warheads and their associated fuze mechanisms may be loaded and configured for service (tactical) or nonservice use. Some large surface-to-air missiles have more than one explosive type warhead while practice warheads for all missiles may be inert loaded with an in-flight destructor charge installed or completely nonexplosive loaded. Service tactical warheads for all missiles are painted overall white. Training heads may be either overall white or blue. A high explosive warhead painted overall white has a solid yellow band no greater than three inches wide painted around the warhead.

Warheads fitted with pyrotechnic components to indicate fuze activation are painted with a one inch light green band adjacent to a one inch brown or yellow band, figure 8-2. Training warheads

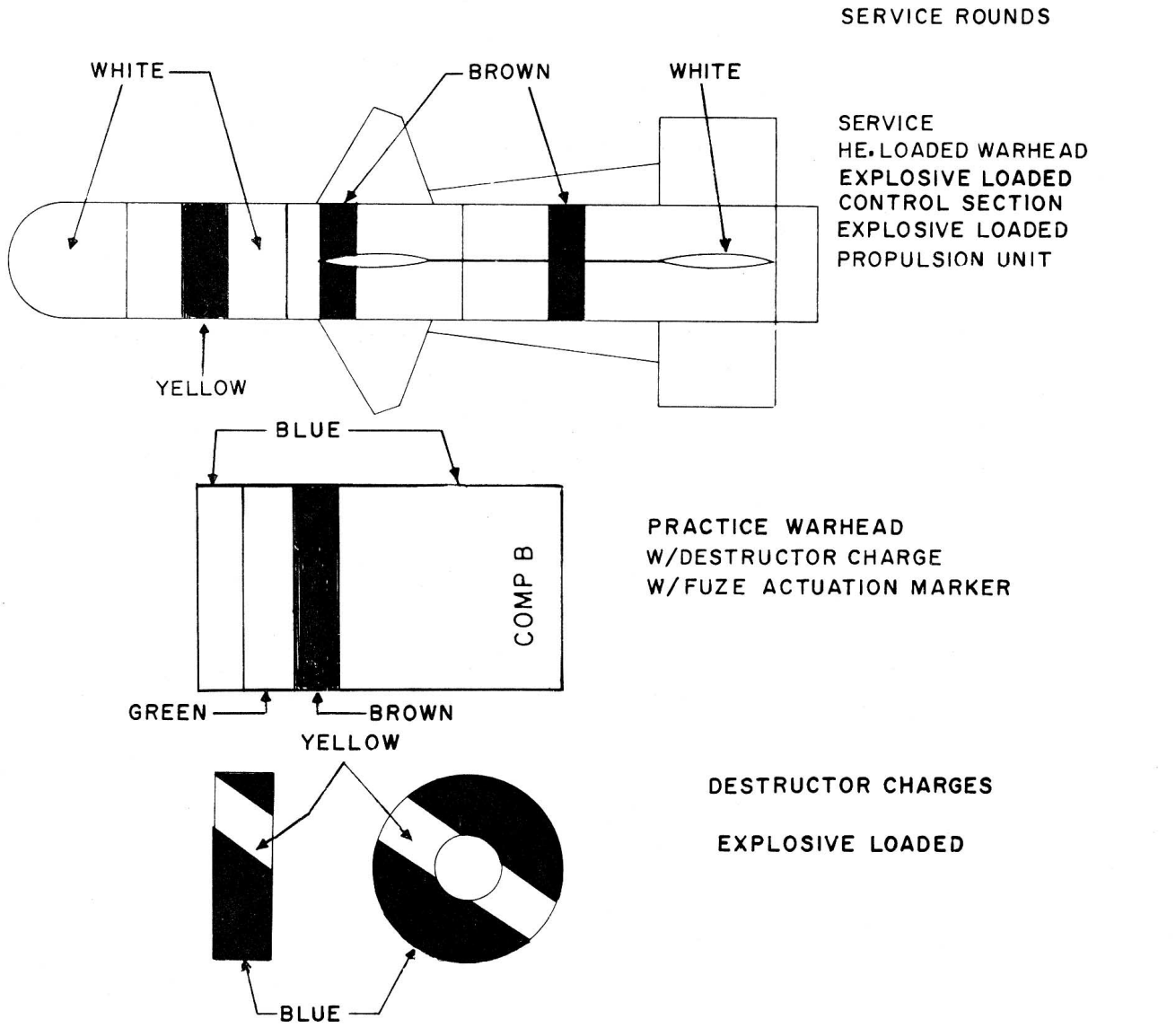

Figure 8-2.—Typical guided missile component painting.

with an explosive destructor charge installed are marked with the symbol COMPB in yellow letters as illustrated in figure 8-2.

Miscellaneous Explosive Devices

Miscellaneous missile explosive devices encompass all independent explosive or pyrotechnic devices that are not components of the missile fuze and warhead or the propellant units and igniters. Items specifically included under this grouping are: in-flight destructor charges, safe arming devices, auxiliary power units, and arming and firing devices. These devices follow the ammunition color coding requirements. Explosive components containing high explosive or having sufficient explosive to function as a high explosive are painted yellow overall or with a yellow band. Explosive components containing explosive amounts sufficient to cause the explosive to function as low explosive or deemed to be particularly hazardous to the user are painted brown or with a brown band.

Training items nonexplosively loaded are painted blue overall or with a blue band.

Practice items may be explosively loaded and have a yellow or brown band painted over the blue overall back ground color, figure 8-2. Anti-submarine rockets (ASROC) used with some Terrier weapon systems are painted gray overall and carry the same ammunition color code specified for guided missiles. Blue is used as an overall color for totally inert training and handling ASROC weapons. Guided missile and rocket designations and ammunition color coding for missile and rocket components are explained and illustrated in Identification of Ammunition, OP 2238.

TESTING

As mentioned before, you do not test propellants, boosters, fuzing and firing units, or sustainers aboard ship. No tests are authorized for these munitions aboard ship. While components are in storage, periodic inspections are made to ensure that the containers are preserving the contents effectively, and that the component has not exceeded its storage life. Storage life of assembled ASROC missiles, for example, is 30 months. Periodically, stored ASROC missiles must be returned to an AD or ASW facility for inspection and replenishment of components. The missile is considered to be in a packaged and preserved condition when stored either in a container or in the launcher magazine. The ASROC Depth Charge, with its nuclear warhead, is also stored in the launcher magazine. Any testing or inspection is done according to the Navy SWOP 44.341, whose classification is higher than that of this publication.

MISSILE MAGAZINES

Surface-to-air guided missiles Terrier, Tartar, Talos and Standard are ready service complete rounds of ammunition. The complete missile represents a mixture of mechanical, electrical, and electronic equipment hazards plus hazards due to several different explosive components. Because of the nature of guided missiles, requirements for their stowage aboard ship differ from the conventional ammunition magazine requirements. Surface launched missile magazines are usually located above the ship's water line. Missile magazines are constructed so that each missile is segregated from one another in cells or trays for easy handling and maximum protection against fire and shock. Missile magazines contain the necessary electric, hydraulic, and pneumatic power operated equipment to stow, select, and deliver a missile from. the magazine to the launcher rail for firing. The location and general arrangement of the various types of missile magazines differ with the type of missile and the type of ship in which the missile system is installed. In some missile magazines, restraining gear is provided to prevent movement of an inadvertently ignited missile motor while the missile is stowed in a cell. Special care is taken with the magazine vent systems to ensure that magazine pressures do not build up to a dangerous level if a missile rocket motor is accidentally ignited. A plenum chamber and vent is provided in Tartar magazines and a relief port for Terrier and Talos magazines which vents the exhaust gases from an accidentally ignited missile to the atmosphere.

In some missile magazines flame barriers are installed between each cell to make them a separate, enclosed compartment open only at the top through which a missile passes during loading and unloading. Figure 8-3 shows this type arrangement used in a Tartar magazine of a Mk 11 GMLS. Missile magazines also contain fire fighting equipment which frequently consists of built in sprinkler systems, water injection systems, carbon dioxide (CO_2) systems, portable dry powder extinguishers, or a combination of these systems.

Missile magazine access doors, flame tight blast doors, and compartment doors should be kept closed at all times except when they must be open to permit passage of missiles, missile components, or personnel. Special emphasis is placed on this requirement during periods of weapon assembly, disassembly, system testing, system firing, or other operations involving missile movements, The same precautions observed in magazine areas must also be observed in all areas of a missile system where weapons are handled or tested.

Explosive and Flammable Components

Combustive missile components are classified under three major categories as follows:

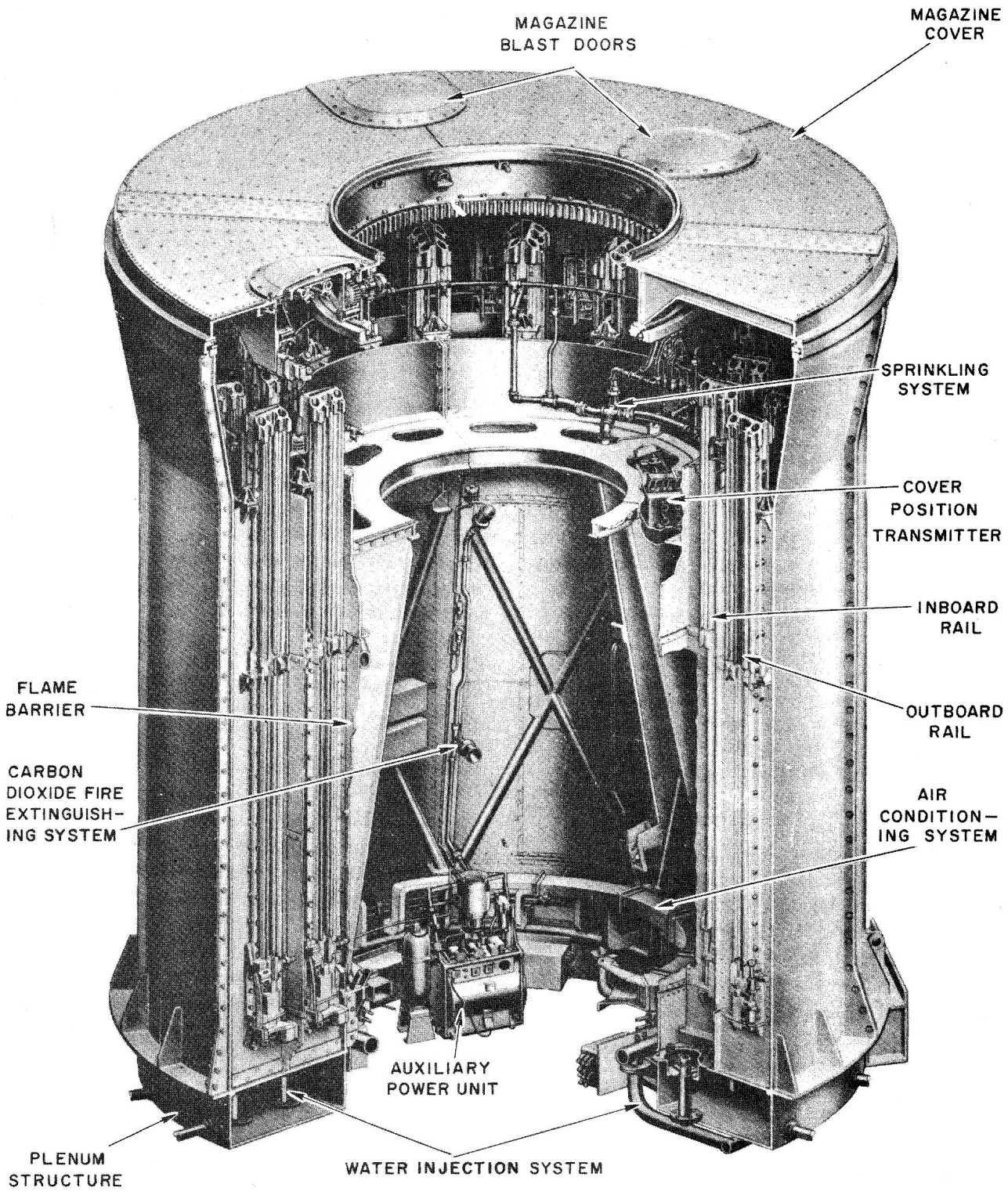

Figure 8-3.—Guided missile magazine.

1. Class" A" is the maximum hazard category which includes items that explode violently when contacted by sparks or flame, or when subject to excessive heat or shock. Items such as the missile warhead and fuze booster are considered Class "A" explosives. All Class "A" explosive components must be handled carefully to prevent their being dropped or otherwise damaged by shock. They must also be protected from intense heat and sparks.

2. Class B is the Flammable Hazard category which includes items that are subject to rapid combustion rather than detonation. The hazards created by Class B explosives are fire, heat, and noxious gases. Missile components such as flash signals, auxiliary power supply, rocket motors and igniters are examples of Class "B" hazards.

3. Class C is the Minimum Hazard category which includes items containing only limited quantities of explosive/flammable materials and are therefore considered insufficiently hazardous to be classified as Class A or B. A typical example of a Class C items are the APS igniter and S and A device.

Missile Component Stowage

Wings, fins, warheads, fuze boosters, fuzes, exercise heads and missile spare parts for Terrier and Talos missiles are stowed in appropriate sections of the missile house. The wings and fins are placed in the racks in the launching system assembly area. Warheads, fuze booster, fuzes, and exercise heads are stowed in racks, bins, and stalls inside the warhead magazine. Nonexplosive complementary components (except wings and fins) are stowed in the missile component storeroom.

Magazine Safety Precautions

Specific safety precautions relating to shipboard stowage of guided missiles are presented in launcher system OPs and in Chapter 4 of OP 4, Vol 2. Listed below are some of the general safety precautions applicable to all missile magazine areas.

1. All magazines shall be kept scrupulously clean and dry at all times. Nothing shall be stored in magazines except missile rounds and the necessary magazine equipment. It is imperative that no oily rags, waste, or other foreign material susceptible to spontaneous combustion be stowed in the magazines.

2. To minimize environmental hazards, the missile magazine is temperature and humidity controlled. It is imperative that the temperature and humidity control systems operate at all times. Inspect missile magazines daily to verify that proper humidity and temperature exist.

3. Personnel must remove all matches, lighters, or any other fire making or spark making devices from their persons before entering a magazine space.

4. Blowout discs and hatches are provided as safety measures to relieve pressure in the magazine in case of rocket motor ignition. The discs and hatches should be inspected periodically to make sure they are operable. They should be clearly marked to show their locations. Personnel should stand clear of the hatch area and the area directly beneath the hoods where the discs are ejected.

5. In the event of accidental ignition of a booster or sustainer in the magazine, stand clear of the magazine until exhaust gases have been completely vented. The gases are toxic and lethal if inhaled in sufficient amounts. A minimum waiting period of 10 minutes after burnout is recommended before approaching the area without wearing special equipment.

6. Precautions should be taken to ensure that heat detectors as well as the sprinkler and CO_2 heads are not covered, damaged, or subjected to any environment that might falsely activate them or impair their utility. Because of the suffocation hazard represented by CO_2 in a closed area, all personnel should disable the CO_2 system before entering a magazine area.

7. If a magazine has been flooded with carbon dioxide, allow 15 minutes for all burning substances to cool down below their ignition temperatures, then thoroughly ventilate the area for an addition 15 minutes to make certain that all portions of the magazine area contain only fresh air. If it is necessary to enter the installation before it is thoroughly ventilated, use a fresh air mask or other type of self contained breathing apparatus.

ORGANIZATION AND ADMINISTRATION OF SAFETY PROGRAMS

In accordance with the Navy policy of conserving manpower and material, all naval activities are required to conduct effective and continuous accident prevention programs. The organization and administration of a safety program applicable to a missile system is the responsibility of the leading gunner's mate within the system. The safety program must be in accordance with local instructions and based on information contained in United States Navy Ordnance Safety Precautions, OP 3347. Adopt work methods which do not expose personnel unnecessarily to injury or occupational health hazards. Post instructions on appropriate safety precautions in appropriate places. Review these signs and instructions frequently and do not allow them to become. rusty, faded, or covered with dirt or dust. Appropriate safety posters and signs may be obtained through the ship's supply department. Give the new men assigned to a missile system safety indoctrination as soon as they report for duty. A supervisor of a missile system should delegate authority to his subordinate petty officers to assist him in training and monitoring a safety program. A supervisor should also include a follow up program which inquires as quickly and as thoroughly as possible into circumstances of accidents and reports of unsafe practices and takes proper action or makes recommendations. When new safety directives and precautions are issued, it is the responsibility of the supervisor to correctly interpret their application to his men.

Organize a formal safety training session for new men and explain each safety subject in detail. The results of unsafe acts are usually the most dramatic and easiest remembered.

Magazine Firefighting Equipment

GMM 3/2, NT 10199, describes the types of missile magazine fire fighting equipment presently installed on board Naval ships. Since fire and explosions are the chief dangers in a magazine where missiles and their explosive components are stowed, prevention of conditions that can cause fire and explosions and the means of fighting fire if it occurs are included in every missile magazine. During the daily inspection of missile magazines examine them carefully for cleanliness, ventilation, temperature, and the general condition of the missiles stowed in the magazine. The temperature and the moisture content of the magazine's atmosphere must be constantly watched. Temperatures are read daily and the maximum and minimum readings recorded in a magazine temperature record book. A magazine sprinkling system has to be inspected and tested monthly. Magazine flooding control systems, quenching systems and installed missile handling equipment must also be inspected for security, safety, and operation periodically.

Missile Magazine Hazards

Most missile magazines contain automatically controlled missile handling equipments which can be hazardous to personnel if safety precautions are not observed. Hazards from moving equipment within the magazine areas can be eliminated by removing or positioning safety switches from a controlling station which stops all equipments within a magazine area. Other hazards such as a suffocation hazard from a CO_2 firefighting system can also be safed by securing valves which feed the system.

Safety instructions posted near the entrance of magazines are very effective if they are easily understood and can easily be complied with. Some standard safety warnings such as: "Suffocation Hazard Secure CO_2 System Before Entering Magazine Areas" and "Danger To Prevent Magazine Motor Activation, Remove Safety Switches From Control Panels" point out the potential danger but do not give instructions about the methods of eliminating the dangers. Where safety methods are not fully explained, the launcher supervisor should instruct all personnel who have access to magazine spaces the proper procedures taken before entering these spaces.

Additional instructions may be posted near the warning signs (figure 8-4) which give information on the location and actions taken to safe a magazine area. Instructions can be made up to read as follows: Suffocation Hazard. Before entering magazine area close the two shut-off valves that serve the carbon dioxide (CO_2)

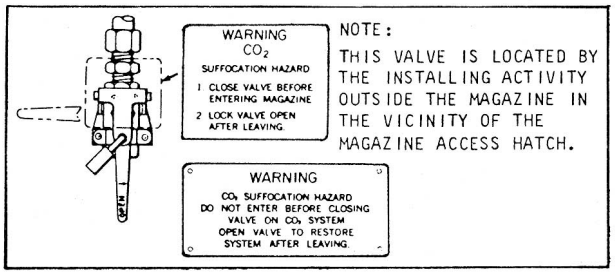

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Figure 8-4.—Additional safety instructions.

system. These valves are located outside the launching system structure in compartment 3-75-4-L. They are normally locked in the open position, accordingly, unlock and close both valves and lock in closed position before entering magazine area.

Safety During Tests and Maintenance

In missile magazines that have both CO_2 and sprinkling systems installed, the control units used to activate these systems could be the same type. An example illustrated and explained in GMM 3&2, NT 10199, is the magazine fire-fighting system used with the Mk 13 GMLS. In this system two control circuits, one for CO_2 and the other for sprinkling systems, are activated by identical heat sensing devices.

A common hazard of a heat sensing device is its method of operation. It is activated by a fusible slug which melts at a predetermined temperature. This action causes a mechanical action to take place which activates either the CO_2 system or the sprinkling system. If a heat sensing device is located too near an operating electric motor or hydraulic unit, the fusible slug could melt from the excessive heat emitted from the units and accidentally activate one of the systems. Because of this hazard, the slugs are checked periodically to ensure their condition. Fusible slugs come in many types which melt at different temperatures. In the Mk 13 GMLS two types are used, one which melts at 174°F for the sprinkling circuit and one which melts at 158°F for the CO_2 circuit. Since all heat sensing devices are identical (except for their fusible slugs), extreme caution must be observed when conducting maintenance on these units. If an inspection reveals that a slug must be replaced, a maintenance requirement card (MRC) will explain all the steps necessary to perform this task and also lists the safety precautions related to the task. A launcher supervisor should research the MR card to ensure that the required actions listed include all additional safety requirements for entering a magazine area. The supervisor should also ensure that all safety instructions are understood by the personnel performing the task. Most MR cards include a statement to observe all standard safety precautions. A standard safety precaution is one that pertains to all types of magazines and is not listed as a specific instruction on the MR card for the maintenance action being performed. An example of a standard magazine safety precaution would be to ensure that no matches, or other flame producing apparatus, are taken into the magazine while it contains explosives. In cases where similarity of systems may cause confusion, the launcher supervisor must take all the necessary additional precautions to ensure personnel safety even though they are not listed on a MR card.

Installing Fusible Slug

Before installing a fusible slug in the heat sensing device of a sprinkling or carbon dioxide system, both systems should be secured regardless of which system is being maintained. When a damaged fusible slug is removed from a heat sensing device, it releases a compressed spring that forces a bellows to collapse. This action causes a sudden pressure change in the heat sensing device. The pressure change causes a mechanical action to take place which actuates either a control head of a CO_2 system or a PRP valve for the sprinkling system, (both systems are explained and illustrated in GMM 3&2, NT 10199). To prevent accidental activation of either system, they both must be secured prior to removing a fusible slug from any heat sensing device.

To secure the carbon dioxide system, disconnect the control heads from the supply cylinders and close off all valves that serve the carbon dioxide system. Also secure all firemain water

pressure valves that serve the sprinkling system and install a sprinkling system test casting into the sprinkling system salt water control valve. When either a PRP valve or a CO_2 control head is activated, its position is shown by an indicator on either unit, see figure 8-5. An activated condition of a PRP valve is shown as the trip position, and for the CO_2 control head, a released position. The position of the control mechanisms is a very important factor when performing a maintenance action. In normal operation the position indicator on a CO_2 control head will move when the bellows of a heat sensing device collapses to produce a sudden pressure increase in the pneumatic lines leading to the CO_2 control heads. The pressure differential causes a diaphragm mechanism to trip an actuating lever which releases a compressed spring. The spring shifts a plunger in the control head mechanism and opens a pilot seat in the cylinder valve, figure 8-6. Liquid carbon dioxide flows through the pilot seat to the upper chamber of the discharge heads, forcing the piston down and opening the control cylinder valve. Opening the cylinder valve releases liquid carbon dioxide from the supply cylinders through shut off valves and into the magazine area where a gaseous snow is produced which quickly reduces temperature and extinguishes fires. During maintenance, the closing off of the shutoff valves prevents carbon dioxide from entering the magazine.

Even though all known precautions are taken, there is still a possibility that a condition could exist which might cause accidental activation of either system. When a new fusible slug is installed in a sensing device as shown in figure 8-7, the bellows must be expanded by a special tool. This tool, called a pull rod, is attached to a section called the collet. When the pull rod is pulled out, the bellows attached to the collet is reset in a position to collapse when a fusible slug melts. The fusible slug holds the extended collet in place, and the collet holds the reset bellows. Resetting the bellows does not automatically reset the tripping mechanism of either the CO_2 control head or the PRP valve, they must be reset manually.

Before reactivating the CO_2 system, check to see if the visual indicator on the control heads is

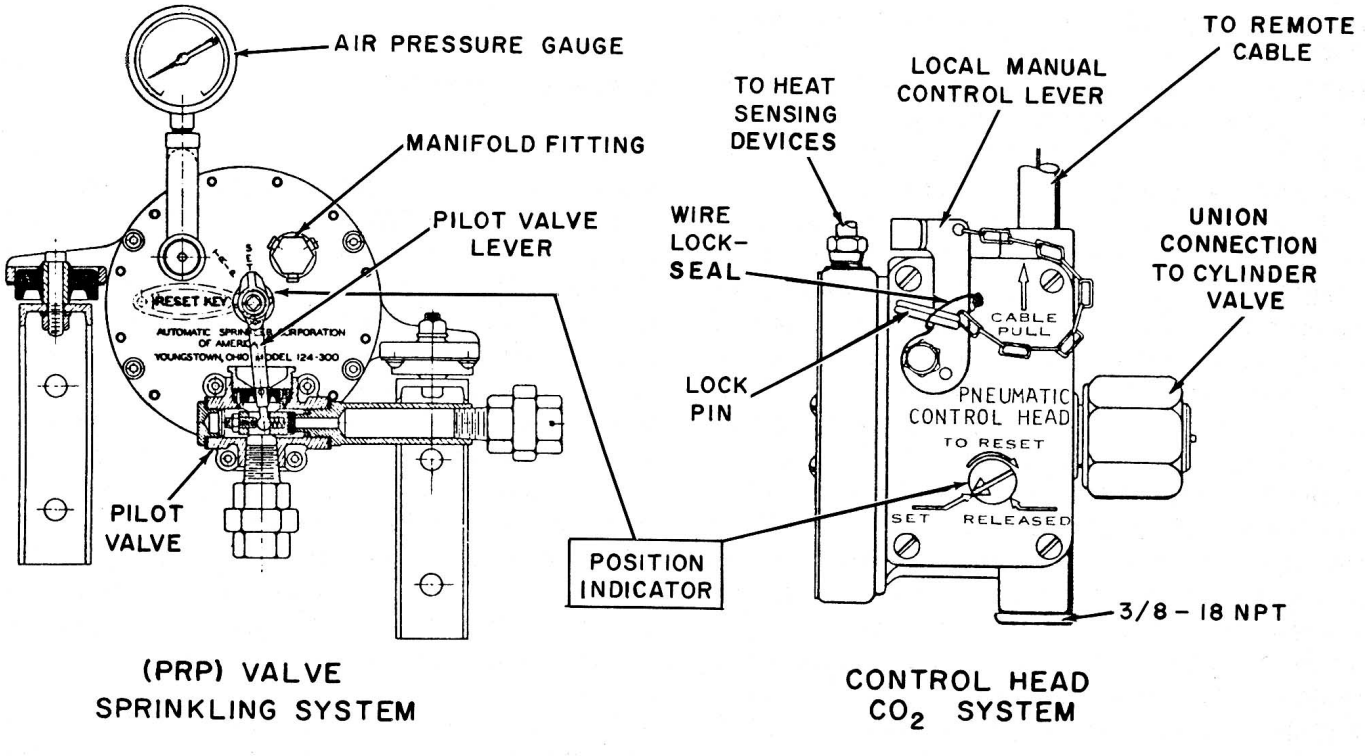

Figure 8-5.—Automatic control devices.

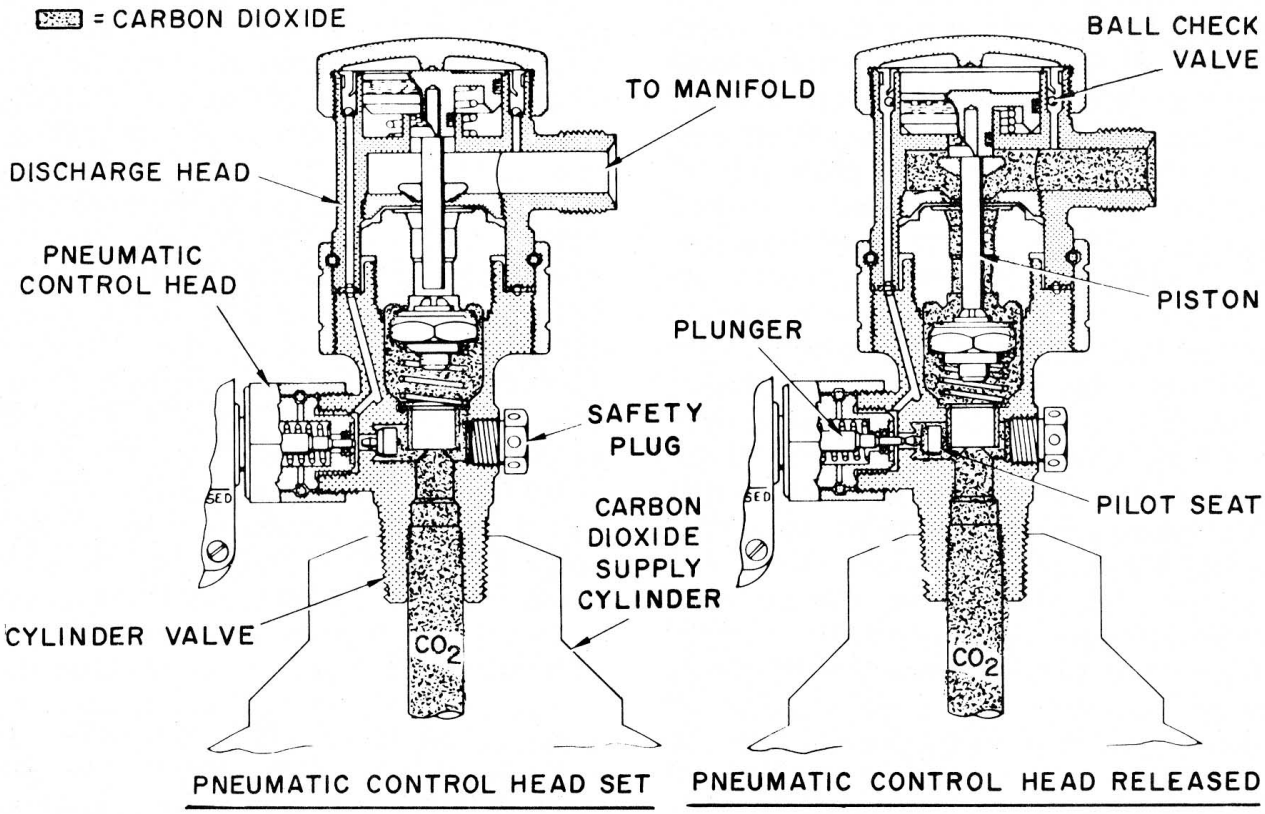

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Figure 8-6.—Cylinder valve, pneumatic control head, and discharge head.

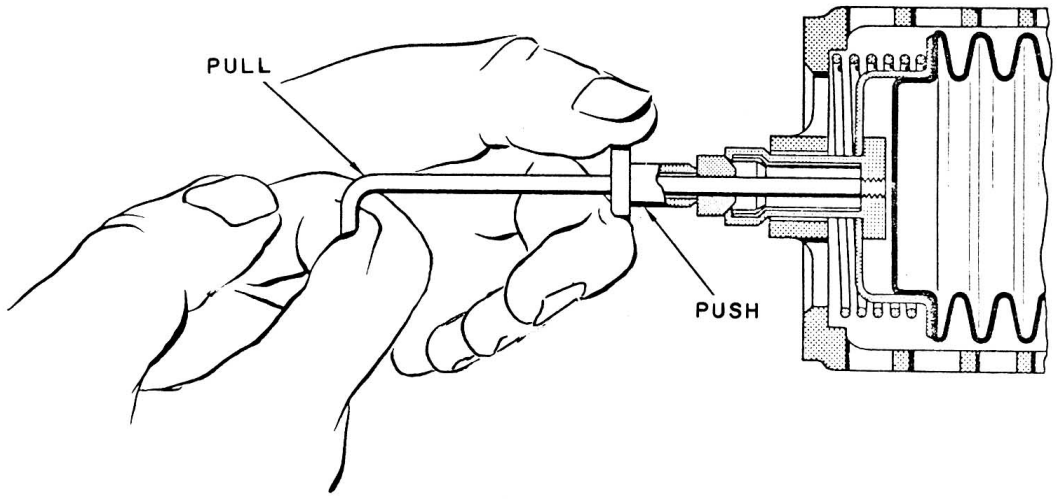

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Figure 8-7.—Installing fusible slug in heat sensing device

in the SET position, figure 8-5. To reset the tripping mechanism on the control head, turn the stem on the visual indicator clockwise with a screwdriver from the released position to the SET position. Slight resistance will be met just before the stem locks.

Before reactivating the sprinkling system, check to see if the visual indicator on the PRP valve is in the SET position. To reset the tripping mechanism of a PRP valve, use a special key to turn the reset mechanism on the front of the valve clockwise from the TRIP position to the SET position, figure 8-5.

OTHER PROTECTIVE DEVICES

All means used to maintain the missiles in the best condition help to prevent accidents. The air-conditioning and ventilation systems installed in the magazine certainly may be considered protective devices in this sense. The heavy construction of the magazines gives protection against blast and fire from accidental ignition of a missile. The blast doors on the magazine provide protection against the blast and exhaust when a missile is fired from the launcher; safety switches prevent firing of the missile until the blast door is closed. Flametight doors are installed between Terrier and Talos magazines and the assembly rooms so the blast and flame from an accidental ignition in the magazine cannot spread to the assembly area. There is no assembly or wing and fin assembly area in the Tartar magazine, but there is a flame tight hatch in the base of the magazine to keep flame and blast from getting into parts of the ship beneath the magazine.

As previously stated in chapter 7 of this text, a blowout pipe is connected to a Terrier missile in the checkout area during missile testing aboard ship. The missile, secured in the checkout stand (car), is positioned in front of the blowout pipe. A blowout pipe adapter is securely attached to both the missile and bulkhead to which the blowout pipe is attached, figure 8-8. If there is an accidental ignition of a missile sustainer motor during checkout, the blowout pipe adapter performs the major function of restraining the missile. The blowout pipe has a water cooling system which injects water into the pipe through a ring about the adapter. Water injection is done automatically by means of a pressure probe downstream in the pipe if missile ignition should occur. With proper operation of the cooling system, the blowout pipe will safely vector the exhaust gas flow to atmosphere.

There are several alarm systems installed in missile magazines which warn personnel of danger to themselves and also alert them to take preventive or corrective action to protect the missiles stowed in magazines. A high temperature alarm, for example, lets personnel know that the magazine is too warm, either because the air conditioning is not operating, or a possible fire. When alarm systems are activated, personnel must investigate and correct the problem before any damage is done to the missiles. There are other types of alarm systems used in a missile magazine which indicate either CO_2 or sprinkling system activation, a radiation hazard, a security violation, and other alarm systems which warn personnel when handling equipment is activated or when missiles are being moved. Missile magazine alarm systems are explained in GMM 3/2, NT 10199.

Plenum Chambers

All Tartar missile magazines have a plenum chamber arrangement which carries off gases and exhaust fumes from an accidentally ignited missile in the magazine. The plenum chamber is in the base of the magazine, beneath the missile. Each cell of a Tartar magazine has a blow-in plate assembly which gives way under pressure when a rocket motor is accidentally ignited and permits high pressure exhaust gases to escape to the atmosphere through the plenum ducts. Figure 8-9 shows a magazine base structure of a Tartar missile magazine used with the Mk 22 GMLS. All missile magazines also have some type of blowout plate which gives way and vents high pressure exhaust that escapes upward in a magazine.

Magazine Anti-Icing System

A major difference between a standard ship-board magazine and a missile magazine is the location aboard ship. Most standard magazines are located below deck and are not subject to outside weather conditions. Missile magazines, because of their function, are located adjacent to or below their launchers. In some GMLS, missiles such as Tartar are loaded directly from their magazine onto launcher guide arms for. firing. Others, such as Talos and Terrier must pass through an assembly area prior to loading

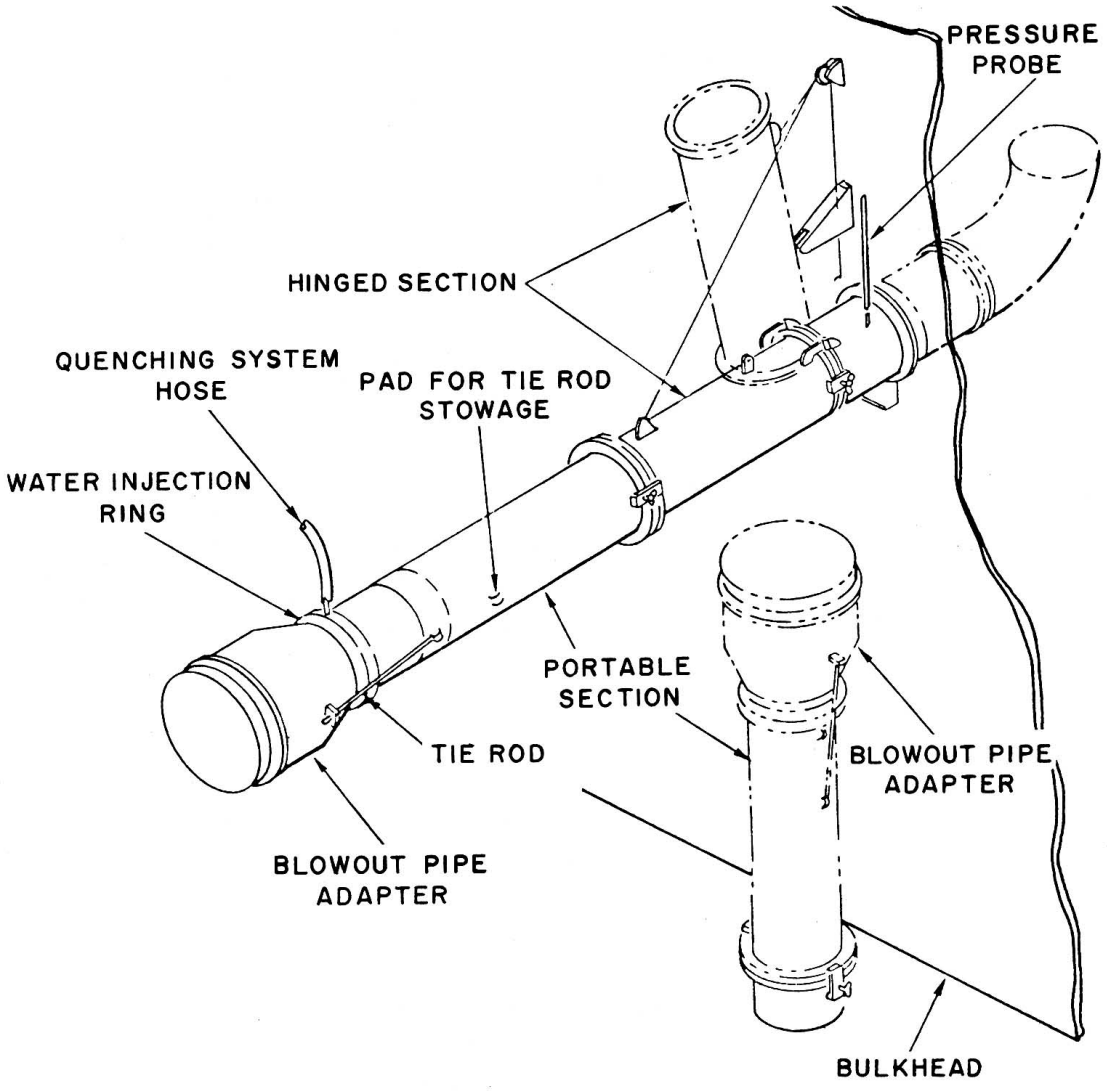

Figure 8-8.—Typical blowout pipe installation.

onto the launcher guide arm. Both systems have a type of blast door or magazine door between the launcher and the missile stowage area which must be opened for loading and closed during firing. These doors and other exposed areas of a launcher and magazine must have an anti-icing system. to prevent ice from accumulating on exterior surfaces during cold weather operations. Heated anti-icing fluid pumped through a closed piping system warms designated areas to keep them free of ice which could interfere with missile loading operations or prevent the function of a safety device. Some of the areas of a Tartar system serviced by an anti-icing system are shown in figure 8-10. These areas - the blast door, blowout plates, magazine cover, and magazine base ring - are considered necessary for both safety and system operation. Since the magazine areas of Talos and Terrier are located within the ship's structure, they have no openings requiring passage of missiles onto a weather deck area. Only the blast doors from the assembly area to the launcher guide arm require anti-icing system

The location of the components for an anti-icing system vary with the type of missile system in which it is installed. All anti-icing systems contain a heat exchanger, a motor driven pump, steam supply lines, valves, and manifolds and supply lines to distribute the

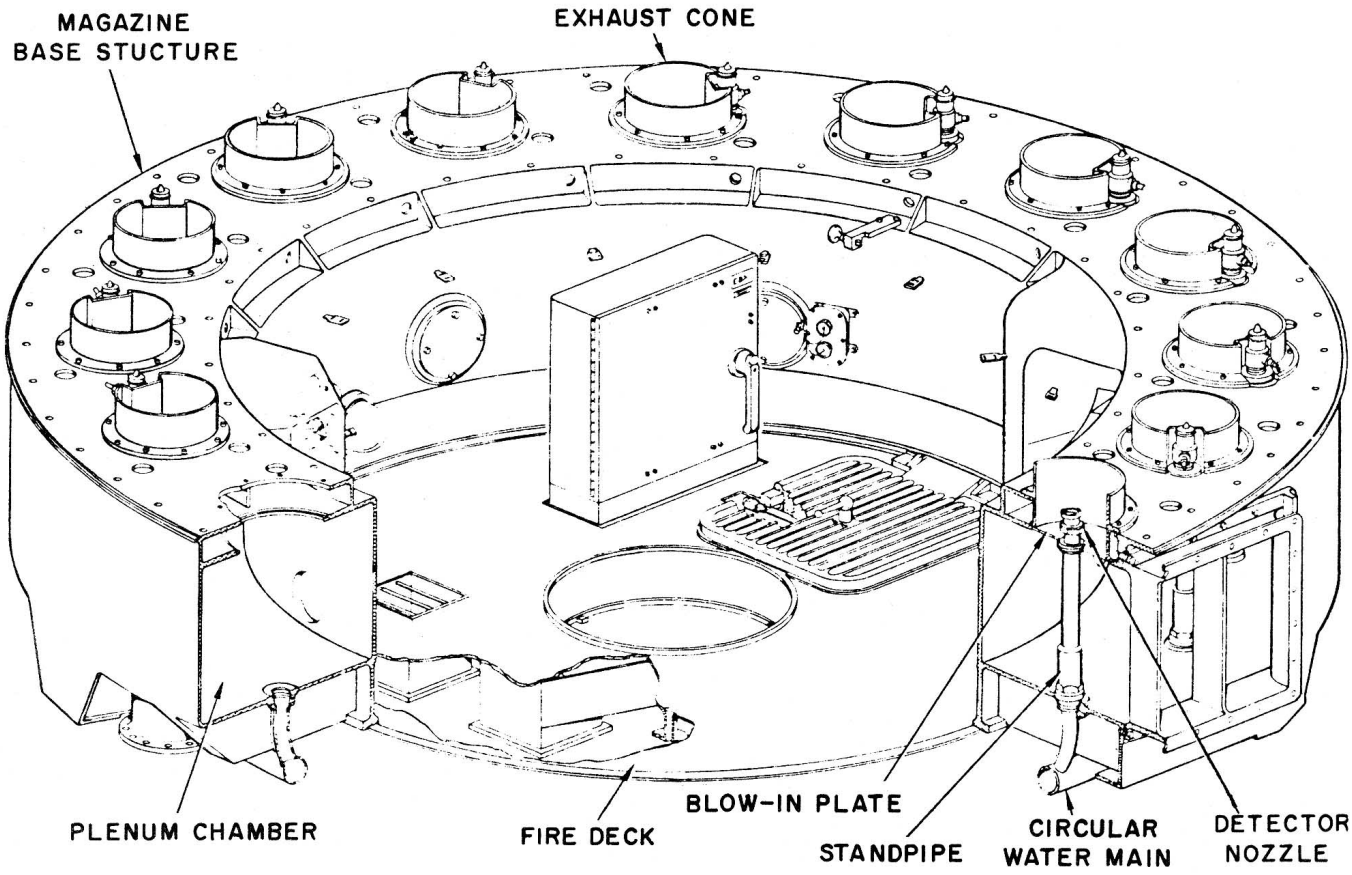

Figure 8-9.—Magazine base.

heated fluid. The heat exchanger is a tank which heats and stores the anti-icing fluid which is made up of a 1 to 1 mixture of distilled water and ethylene glycol. The motor driven centrifugal pump circulates the heated fluid through the system. Fluid in the system is heated by ship's stream in the heat exchanger and recirculated throughout the system by a network of piping and flexible hoses. A temperature control unit (thermostat) is installed on the heater tank and is set at a temperature which is adequate to prevent icing.

Ventilating System

A missile magazine ventilating system cools the missiles stored in cells or racks with air provided by a ship's air conditioning system. Air enters and leaves the magazine area through ducts and circulates throughout the magazine to maintain the proper stowage temperature. The humidity at which missiles and their components are stored is a very important factor and if not properly controlled, may cause serious deterioration of some types of explosives and also cause rust, corrosion, and fungus growth on both exterior and interior components of a missile. Air conditioning systems are adjusted automatically to maintain the optimum moisture content of the air within a magazine area.

Missile components that are packed in shipping containers contain a quantity of desiccant and are packaged in sealed moisture proof paper or sealed in a pressurized container and have a humidity indicator placed where it can be read without opening the container. When a missile is assembled into a complete round, the components that make up the round are no longer kept dry by a desiccant unit. For this reason the humidity of the air within a magazine

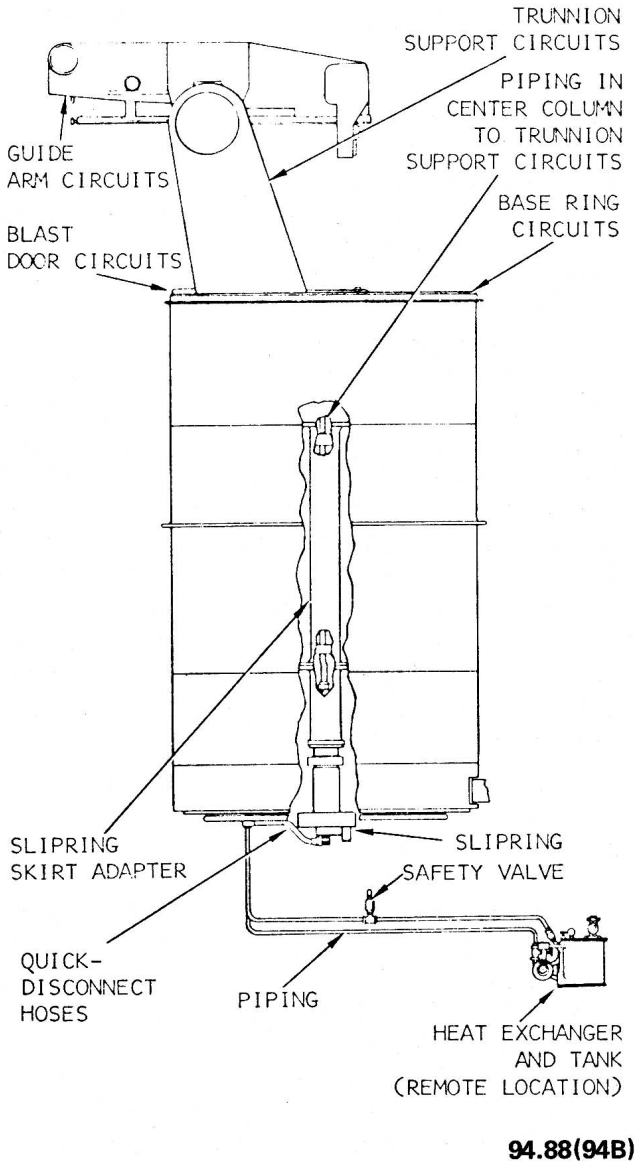

Figure 8-10.—Anti-icing system arrangement.

area is automatically regulated by the air conditioning unit that serves the magazine. These units are maintained by personnel in the engineering and hull ratings and require no test or maintenance by the GMM.

If moisture is found on missiles, bulkheads, or machinery within a missile magazine, it should be called to the attention of personnel maintaining the air conditioning units. The humidity of the air in the magazine can. be checked to determine the efficiency of the air conditioning system feeding the missile magazine area. Keeping the air filters clean in an air conditioning system helps maintain the proper temperature and humidity level.

MAGAZINE INSPECTION RECORDS AND REPORTS

The missile magazines that are part of the missile launching system are in use every day for some part of the training, maintenance, and repair operations. The magazines can be inspected during the course of daily work. Before anyone enters the launcher magazine, be sure to inactivate it and remove the switch handle from the control panel so no one can activate any of its machinery while someone is within.

On the missiles look for leakage of hydraulic oil, lubricants, or rocket fuel, and report leakages for repair.

Daily inspection trips must be scheduled to the magazines for spare components, as these are not opened except to obtain a spare component. The magazines are kept locked. Teach your men what to look for when they inspect the magazine. Every day inspect the general condition of the magazine-cleanliness, ventilation, dryness, (note any signs of dampness or "sweating"), lighting, presence of unauthorized tools and gear, temperature, presence of any odors indicating decomposition of explosives, escape of, gases, or other indication of anything amiss. Find the source of any odor and remedy the trouble. You may need the assistance of the Explosive Ordnance Disposal Team. With modern, air-conditioned magazines, explosives usually remain in good condition for a long time.

Detonators, of course, should not be in the same magazine with rocket boosters, propellants, etc., unless they are in an assembled warhead in a missile. Little pools of exudate may form in detonator wells, from which they must be removed with the greatest care. This exudate is extremely sensitive, and removal should not be delayed. A sample of the exudate must be sent for analysis. See OP 4, Volume 2, Ammunition Afloat, for instruction.

Notice the condition of the containers. There must be no open or damaged containers, no spilled powder or broken propellant grains, and no dust, dirt, trash, or combustible materials about. Containers should be neatly stacked and

fastened down so there is no shifting, slipping; or rolling about. Remove damaged containers to another compartment for repair.

If there are windows or ventilation openings, be sure that sun and rain are kept out and that the screening is intact. In an air conditioned magazine, the ventilation openings are secured except for blow-out purposes during General Quarters, or for emergency use. Be sure the lights are working and that there are no shorts to cause sparks. The door must be flametight: if it is even slightly sprung, have it repaired at once. The fire extinguishers, firehose, and water buckets should be in ready condition, neatly placed in convenient locations...

A checkoff sheet listing all the items to be checked in the magazine area is a practical necessity. Depending on how often the weapons officer wants the report turned in, it may contain spaces for the daily checking for a week or for a month.

Magazine temperature records and magazine logs are maintained by each command for every magazine and ready service locker aboard ship and selected magazines ashore. On shore stations a representative number of magazines in each group, containing representative quantities of each type of explosive material, are inspected each day with different magazines within the respective groups being inspected on successive work days until all magazines have been inspected. Frequency of inspections ashore may be varied on the basis of prevailing outside temperatures. The date and hour of each inspection shall be noted and recorded in a magazine inspection log over the signature of the person who makes the inspection. Substandard or abnormal conditions shall be reported promptly to the supervisor in charge for correction and the conditions observed noted in the log. When conditions are satisfactory and normal, this also shall be noted in the log by the entry "normal". Magazine inspection logs ashore may be destroyed when one year old. Magazine inspections ashore shall be made during daylight hours when there is sufficient light to assure that any existing substandard conditions can be seen and reported. Magazines are inspected to determine if repairs are needed, to make sure that the safety regulations, particularly those with regard to cleanliness and elimination of fire hazards, are being observed and to ascertain that materials are not deteriorating into an unsafe condition and that they are stored in an orderly, approved manner as specified in NAVORD OP 5, Vol 1, Ammunition and Explosives Ashore.

Aboard ships, daily entries of temperatures are recorded on magazine temperature cards, department record magazine logs, and the ship's official deck log and serve to document the magazine inspection records. Identification of the magazines that experienced maximum and minimum temperatures since the previous inspection plus a notation of any abnormal physical conditions observed completes the report. If no abnormal conditions are observed, the notation of "conditions normal" should be made. Whenever abnormal conditions in magazines or missiles are discovered and recorded, the facts shall be reported in person to the commanding officer or command duty officer and further relayed to ensure that all personnel concerned are officially notified so that the necessary corrective action may be initiated promptly.

Inventory Record of Small Arms and Pyrotechnics

Small arms are issued to you and your men for guard duty, and must be strictly accounted for on an individual basis. You will not have stores of small arms in your care, nor will you have stocks of small arms ammunition. These will be issued to you as required, and you are accountable for them. NAVORDINST 8370.1 gives the instructions for reporting lost, stolen, and recovered small arms. A letter report is required in each instance.

The special pyrotechnic items on missiles, the tracking flares and flash units, are issued to each ship in the quantity designated by the ship's COSAL. The quantity is determined by the number and kinds of missiles on the ship and the mission of the ship. If a lengthy training cruise is scheduled for the ship, more pyrotechnic items will be needed than for a tactical mission. When the ship was loaded and outfitted, the quantity of each item had to be checked against the COSAL, and the amount entered on the ammunition inventory. When any item is used, it must be deleted from the inventory. The number of

items in the pyrotechnic locker should always match the number listed in the inventory.

Other Navy pyrotechnic items that are not used on missiles are not part of your inventory, but you must know how to stow them and how to use them correctly and safely. Containers of pyrotechnic items that show signs of dampness or moisture must be opened. If there is evidence of moisture on the pyrotechnics, a report must be made to NAVORDSYSCOM, and instructions requested for disposition of the damaged articles, which must be segregated from all other items.

Gunner's Mate M (Missiles) 3&2, NAVTRA 10199, contains material on pyrotechnics with illustrations and diagrams to supplement the text. *Ammunition Afloat*, OP 4, vol. 2, gives the official rules for care and maintenance, surveillance, stowage, and disposal of various types of pyrotechnics. Be sure to get the latest revision of this volume; rules have been made more precise and stringent because of recent disasters caused by mishandling of pyrotechnics.

Ammunition Records and Reports

Due to ammunition's essentiality to naval operations, and because of its high cost and other unique logistic characteristics, ammunition status is under careful and continuous study at the highest echelons of the defense establishment, as well as by operational and logistics commanders. It is vital that an accurate and prompt method of reporting ammunition stock status be available to commanders of naval forces. For this reason commanding officers of ships and shore activities are responsible for submitting reports regarding all receipts, transfers, expenditures, and quantities of all ammunition components within their command.

A quarterly ammunition report is made to Navy Ships Parts Control Center (SPCC), Mechanicsburg, Pennsylvania, so that an accurate inventory of assets and expenditures of expendable ordnance items throughout the Naval service can be maintained. A quarterly ammunition report includes all conventional expendable ordnance material, including gun-type, bombs, rockets, ASW weapons, guided missiles, military chemicals, mines, torpedoes, demolition and pyrotechnic materials assigned a four digit NALC (Navy Ammunition Logistics Code) in accordance with NAVORD OD 16135, and excludes nuclear ordnance. The frequency of ammunition assets and expenditures report made to fleet commanders and other command authority is outlined in COMSERVLANTINST 8015.1 (Series) and COMSERVPACINST 8015.5 (Series) as appropriate. Most ships report monthly to Commander Service Forces Atlantic or Pacific who will in turn report to SPCC. These reports, when processed by SPCC, provide Naval Ordnance Systems Command with information concerning expenditure rates, ammunition availability; and facts from which fleet requirements can be determined.

There are numerous other reports that have to be made periodically concerning ammunition afloat and ashore. These reports include complete ammunition identification data, including lot number, mark, and modification numbers and NAL codes of all ammunition and components. Some of the information required in these reports are;

1. Available stowage space of the activity.
2. Types and numbers of missiles used for training.
3. Performance of ordnance equipment.
4. Performance of pyrotechnics and other ammunition components used.

Reports on Missiles

Ships reporting complete rounds of surface to air missiles in accordance with OD 16135 must in addition to reporting receipts; issues, and expenditures include reclassifications and reconfigurations due to installation of alternate or exercise missile components. Some missiles can be reclassified from a service round to an exercise round by exchanging a missile warhead for an exercise head. A missile's NALC code number will change when the missile is fitted with an exercise head. OD 16135 lists a Terrier missile with a warhead as NALC-1600, and a Terrier missile with an exercise head as NALC 1601. If a missile is received aboard as a service missile and previously reported with a NALC 1600 number indicating a warhead shot and is reconfigured as an exercise round, the missile is then reported with a NALC 1601 number indicating an exercise shot. The warhead removed from the

service missile must also be reported with its own NALC identification. In addition activities reporting surface to air missiles or boosters must include a serial number for each missile or booster being reported.

Emergency (message) Expenditure Reports are made according to instructions promulgated by the fleet commander, area commander, or other authority. NAVORDINST 8025.1 "Accidents and incidents involving nonnuclear explosive ordnance, materials, and devices; report of," establishes regulations that apply to all ships and stations regarding such reports. (See chapter 11.) It defines and differentiates between an explosive accident and an explosive incident. When a nuclear component is involved, special reports are made and special rules apply (OPNAVINST 8110.16C or later revision).

LIMITATIONS IMPOSED BY NUCLEAR WARHEADS

If you have missiles or depth charges with nuclear warheads, the storage conditions must meet the requirements for the nuclear component. For specific information on the temperature and humidity limitations for certain nuclear weapons, general information on storage requirements for nuclear components, and the storage limitations of the missiles and depth charges you have aboard, consult the Navy SWOPs for those weapons. The classified publications custodian in your division has charge of those publications. Navy SWOP 35-49 gives the instructions for preparing report form NAVORD 8110/10, "Nuclear Weapons Information Report," and NAVORD Form 8110/11, "Nuclear Weapons Inspection Summary;" while Navy SWOP 5-8 tells about NAVORD Form 8110/14, "Special Weapons Unsatisfactory Report." Until the new forms are available, Navy activities may use NAVORD Form 2795 (6-60) to report material discrepancies. If the material is in dangerous condition, Emergency URs are sent to the Naval Ammunition Depot, McAlester, Okla. 74501, plus copies to NAVORDSYSCOM, ORD-0822, Washington, D.C. 20360.

Items received in damaged condition are reported on DD Form 6, "Report of Damaged or Improper Shipment."

The Inspection Summary is sent each month the other reports are sent when there are changes to report.

Missiles containing war reserve nuclear warheads are never loaded on the launcher except when actual firing is anticipated. Dummy, practice, or exercise warheads are used for all other purposes (training, maintenance, checkout, exercise). Dummy warheads have merely the outward appearance of the real thing.. A mockup not only has the outside appearance, but it can be assembled and disassembled. A training warhead is an elaborate mockup. There are six categories, according to the extent each uses live or dummy components.

Training weapons are of several categories, depending on the completeness of the weapon. If you are going to use it only for practice in putting a missile into the magazine and bringing it up to the launcher, the size, weight, and conformation of a real missile are all that are needed.

All Navy and Marine activities having custody of training weapons, component assemblies, or test and handling equipment associated with nuclear ordnance must make semiannual reports. NAVORD Form 8110/2, "Modernization Status Report, Training Weapons and Test and Handling Equipment," is the report form to be used for this. It is explained in Navy SWOP 40-13.

SUMMARY

Missiles, to be of any value in defensive war, must be completely assembled and ready to go on very brief notice. This assemblage of extremely dangerous and powerful components makes necessary meticulous adherence to safety rules and highly effective fire fighting and protective systems. You are expected to have learned the qualities of different explosives as a GMM 3 and 2. Now you are expected to supervise the handling of explosive components and assembled missiles, and to enforce the safety regulations.

Considerable attention is given to the types of protection included in the magazines and other parts of the launching system. You not only must know how to operate these systems, but you must be able to repair them, test them, and keep them operating efficiently.

The problems created by having missiles with nuclear warheads in the same magazine with missiles with conventional explosives is not treated to any extent because of security classification.

As soon as you know what weapons you have aboard, find out the special precautions that apply. You and your men have to handle and stow the assembled missiles that contain the nuclear warheads. You therefore must know what to do in emergencies, and you must know all special rules for handling and stowage, such as humidity and temperature limits, and what to do in case of an accident or incident. One of the most frequent criticisms found in reports of investigations of explosive accidents or incidents is that no one seemed to know just what to do and precious time was lost in getting organized to take effective action. This indicates strongly that more organized drill is necessary so someone is ready to take the lead and the men know just what to do.