

DDS 522-2

DESIGN DATA SHEET

MISCELLANEOUS WET-TYPE SPRINKLING SYSTEMS



DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
ARLINGTON VA 22242-5160

DISTRIBUTION AUTHORIZED TO DOD AND DOD CONTRACTORS ONLY;
CRITICAL TECHNOLOGY, 27 APRIL 1995. OTHER REQUESTS SHALL BE
REFERRED TO NAVAL SEA SYSTEMS COMMAND (SEA 03G)

DESIGN DATA SHEET
DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND

DDS 522-2
27 April 1995

MISCELLANEOUS WET-TYPE SPRINKLING SYSTEMS

CONTENTS

| <u>Paragraph</u> | <u>Title</u> | <u>Page</u> |
|------------------|---|-------------|
| 522-2-a. | References | 1 |
| 522-2-b. | Introduction | 2 |
| 522-2-c. | Incinerator Room | 3 |
| 522-2-d. | Lubricating Oil Storeroom | 8 |
| 522-2-e. | Dry Stores Cargo Hold | 13 |
| 522-2-f. | Cargo Handling Deck | 19 |
| 522-2-g. | Flammable Gas Cylinder Storeroom | 25 |
| 522-2-h. | Carpenter Shop/Lumber Storage | 30 |
| 522-2-i. | Trash Compactor Room | 35 |
| 522-2-j. | Paint Spray Room and Paint Spray Booth | 40 |
| 522-2-k. | Aviation Tire Storeroom | 45 |
| 522-2-l. | Living Spaces | 50 |
| 522-2-m. | Vital Area Perimeter | 55 |
| 522-2-n. | Solid and Plastic Waste Reprocessing Room | 60 |
| 522-2-o. | Rubber and Plastic Shop | 65 |

TABLES:

| | | |
|----------|-------------------------------|----|
| Table 1: | Sprinkler Deflector Clearance | 70 |
|----------|-------------------------------|----|

FIGURES:

| | | |
|-----------|-----------------------------------|----|
| Figure 1: | Configuration of Pendant Downlegs | 71 |
|-----------|-----------------------------------|----|

522-2-a. References

- (a) General Specifications for Ships of the U.S. Navy, Section 521
- (b) MIL-S-24686, Sprinkler, Automatic, Quick Response
- (c) MIL-S-16032, Switches and Detectors, Shipboard Alarm System
- (d) NFPA 13, Standard on Installation of Sprinkler Systems

522-2-b. Introduction

This design data sheet is issued to establish uniform design practices and criteria pertinent to the development of miscellaneous wet-type seawater sprinkling systems for fire protection on surface ships in the U.S. Navy. The scope does not include dry-type sprinkling systems such as for magazines. This design data sheet supplements the requirements in the General Specifications, Reference (a), and Ship Specifications. The use of this document is required for all surface ship designs prepared by NAVSEA, unless written exception is granted by NAVSEA.

522-2-c. Incinerator Room

c.1. Application Rate.

The water flow density for the sprinkled area shall be between 6.1 L/min/m² (0.15 gpm/ft²) and 12.2 L/min/m² (0.30 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-c.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-c.2., below).

c.2. Sprinkled Area. (See 522-2-c.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

c.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 93°C (200°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-c.6.k. and 522-2-c.6.m.)

c.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

c.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of ten. It shall be assumed that the ten sprinklers furthest from the supply header shall be actuated (the ten sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than ten sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

c.6. Nozzle Arrangement.

c.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the application rate for the compartment does not exceed the maximum specified in

522-2-c.1., above. Sprinklers need not be placed to wet all surfaces, but sprinkler spacing shall ensure that a fire would be contained.

- c.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- c.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1. For spaces with a drop or false ceiling, pendant type sprinklers shall be located beneath false or drop ceiling such as to provide as much overhead room as practical.
- c.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-c.6.c. shall apply. In the case of screened stowage areas, the requirements specified in 522-2-c.6.n. shall apply.
- c.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- c.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- c.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- c.6.h. Sprinklers shall not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- c.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.

- c.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.
- c.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment.
- c.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- c.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- c.6.n. Screened Stowage Areas. Areas within the incinerator room that are screened in for stowage of trash shall be provided with at least one sprinkler head within the screened area. Additional sprinklers shall be provided only for large areas where the spacing requirements in 511-2-c.6.a., above apply.

c.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

c.8. Group Criteria.

The sprinkling of an incinerator room shall be in a single group.

c.9. Firemain Supply.

- c.9.a. The supply source for incinerator room sprinkling shall be taken from one segregation of the firemain.
- c.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-c.4., above and the number of sprinklers operating as specified in 522-2-c.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

c.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-c.12., below). Exceptions to this requirement shall be approved by NAVSEA.

c.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

c.12. Piping Arrangement.

c.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.

c.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).

c.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

c.13. Spares and Tools.

c.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.

c.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-c.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

c.14. System Alarm.

c.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.

c.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.

- c.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
 - c.14.d. The flow switch setting shall be 76 L/min (20 gpm).
 - c.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.
- c.15. Preventive Maintenance.
- c.15.a. Flush out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
 - c.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
 - c.15.c. A pressure tap shall be installed immediately downstream of the control valve. The pressure gage shall be installed for each tap outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
 - c.15.d. Flush out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.
- c.16. Operational Provisions.
- c.16.a. Valve and system identification shall be provided as required in the applicable specifications.
 - c.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
 - c.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open for sprinkling and showing the sprinkled area.
- c.17. Room Drainage.

The incinerator room shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-d. Lubricating Oil Storeroom

d.1. Application Rate.

The water flow density for the sprinkled area shall be between 16.3 L/min/m² (0.40 gpm/ft²) and 24.4 L/min/m² (0.60 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-d.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-d.2., below).

d.2. Sprinkled Area. (See 522-2-d.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/ spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

d.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-d.6.k. and 522-2-d.6.m.)

d.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

d.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 27. It shall be assumed that the 27 sprinklers furthest from the supply header shall be actuated (the 27 sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 27 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

d.6. Nozzle Arrangement.

d.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the

application rate for the compartment does not exceed the maximum specified in 522-2-d.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- d.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- d.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- d.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-d.6.c. shall apply.
- d.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- d.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- d.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- d.6.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- d.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- d.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.

d.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage.

d.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.

d.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.

d.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

d.8. Group Criteria.

The sprinkling of a lubricating oil storeroom shall be in a single group.

d.9. Firemain Supply.

d.9.a. The supply source for lubricating oil storeroom sprinkling shall be taken from one segregation of the firemain.

d.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-d.4., above and the number of sprinklers operating as specified in 522-2-d.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

d.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-d.12., below). Exceptions to this requirement shall be approved by NAVSEA.

d.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as a flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

d.12. Piping Arrangement.

- d.12.a.** Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- d.12.b.** The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- d.12.c.** Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

d.13. Spares and Tools.

- d.13.a.** A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- d.13.b.** A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-d.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

d.14. System Alarm.

- d.14.a.** A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed outside the protected space in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- d.14.b.** The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- d.14.c.** Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- d.14.d.** The flow switch setting shall be 76 L/min (20 gpm).
- d.14.e.** The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

d.15. Preventive Maintenance.

- d.15.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system at each branch line to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- d.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- d.15.c. A pressure tap shall be installed immediately downstream of each control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
- d.15.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

d.16. Operational Provisions.

- d.16.a. Valve and system identification shall be provided as required in the applicable specifications.
- d.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
- d.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

d.17. Room Drainage.

The lubricating oil storeroom shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2.e. Dry Stores Cargo Hold

e.1. Application Rate.

The water flow density for the sprinkled area shall be between 6.1 L/min/m² (0.15 gpm/ft²) and 12.2 L/min/m² (0.30 gpm/ft²). The application rate shall be calculated for each group by multiplying the total number of sprinklers (located in accordance with 522-2-e.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-e.2., below).

e.2. Sprinkled Area. (See 522-2-e.6., below.)

Determination of the total sprinkled area shall be calculated for each group based on the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

e.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-e.6.k. and 522-2-e.6.m.)

e.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

e.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of ten for each sprinkling group. It shall be assumed that the ten sprinklers furthest from the supply header shall be actuated (the ten sprinklers from each group which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than ten sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

e.6. Nozzle Arrangement.

e.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the application rate for the compartment does not exceed the upper limit specified

in 522-2-e.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

Note: Some cargo holds include fixtures which enable the installation of temporary partitions. The designer should consider the potential location of these partitions when arranging nozzles. Nozzles should be arranged equal distance between closely spaced temporary partitions, whenever feasible.

- e.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- e.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- e.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-e.6.c. shall apply. Wire screens used to enclose stowage areas within the hold need not be considered an obstruction and the general spacing requirements in 522-2-e.6.a, above shall apply.
- e.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- e.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- e.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- e.6.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.

- e.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- e.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head for the purpose of replacement, without removal of interference or supply piping.
- e.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage. The sprinkler head shall be configured in a way to minimize the possibility of damage to the head from operation of fork trucks, moving equipment and stowage of cargo. Upright sprinklers shall be used for these installations.
- e.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- e.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- e.6.n. Cargo hatches and elevators. Sprinklers shall be arranged around the perimeter of large cargo hatches and open elevators to ensure coverage of the opening. Hatches and open elevators having widths in excess of 2.7 m (9 ft.) shall have sprinklers located within 0.3 m (1 ft.) of the opening, spaced at intervals not to exceed 1.8 m (6 ft.), around the entire perimeter of the opening. This reduced spacing is not required around closed elevators (with doors).

Note: For very large cargo hatches having widths in excess of 7.6 m (25 ft.), a supplementary standpipe sprinkling system should be provided. This open head system should be manually operated and consist of 30° and 80° fan type nozzles in accordance with NAVSEA Drawing number 803-1385828, located around the hatch perimeter to cover areas not protected by automatic sprinkling.

e.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

e.8. Group Criteria.

The sprinkling of a dry stores cargo hold shall be in groups, with one sprinkling group for each level of the hold that can be enclosed.

e.9. Firemain Supply.

- e.9.a. The supply source for each group of the dry stores cargo hold sprinkling shall be taken from one segregation of the firemain. The firemain which feeds the supply source shall be sized to support simultaneous operation of all sprinkling groups within the cargo hold.
- e.9.b. The minimum required supply pressure for each group shall be calculated based on the minimum nozzle pressure specified in 522-2-e.4., above and the number of sprinklers operating as specified in 522-2-e.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

e.10. System Control.

The supply source for each group shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment (if feasible), adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-e.12., below). Exceptions to this requirement shall be approved by NAVSEA.

e.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as a flexible cable for the group control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

e.12. Piping Arrangement.

- e.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- e.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- e.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

e.13. Spares and Tools.

- e.13.a.** A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- e.13.b.** A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-e.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers.

e.14. System Alarm.

- e.14.a.** A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed outside the protected space in the line immediately downstream of the group control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- e.14.b.** The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- e.14.c.** Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- e.14.d.** The flow switch setting shall be 76 L/min (20 gpm).
- e.14.e.** The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

e.15. Preventive Maintenance.

- e.15.a.** Flush-out connections shall be provided at the most remote portions of the sprinkler system at each branch line to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- e.15.b.** A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- e.15.c.** A pressure tap shall be installed immediately downstream of each group control valve. A pressure gage shall be installed for each tap. Each gage shall be

located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.

- e.15.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.
- e.16. Operational Provisions.
 - e.16.a. Valve and system identification shall be provided as required in the applicable specifications.
 - e.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
 - e.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.
- e.17. Hold Drainage.

The dry stores cargo hold shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-f. Cargo Handling Deck

f.1. Application Rate.

The water flow density for the sprinkled area shall be between 6.1 L/min/m² (0.15 gpm/ft²) and 12.2 L/min/m² (0.30 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-f.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-f.2., below).

f.2. Sprinkled Area. (See 522-2-f.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

f.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-f.6.k. and 522-2-f.6.m.)

f.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

f.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of ten. It shall be assumed that the ten sprinklers furthest from the supply header shall be actuated (the ten sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than ten sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

f.6. Nozzle Arrangement.

f.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the application rate for the compartment does not exceed the upper limit specified

in 522-2-f.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- f.6.b Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- f.6.c Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- f.6.d Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-f.6.c. shall apply.
- f.6.e Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- f.6.f Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- f.6.g Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- f.6.h Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- f.6.i Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- f.6.j Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.

- f.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage. The sprinkler head shall be configured in a way to minimize the possibility of damage to the head from operation of fork trucks, moving equipment and stowage of cargo. Upright sprinklers shall be used for these installations.
- f.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- f.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- f.6.n. Cargo hatches and elevators. Sprinklers shall be arranged around the perimeter of large cargo hatches and open elevators to ensure coverage of the opening. Hatches and open elevators having widths in excess of 2.7 m (9 ft.) shall have sprinklers located within 0.3 m (1 ft.) of the opening, spaced at intervals not to exceed 1.8 m (6 ft.), around the entire perimeter of the opening. This reduced spacing is not required around closed elevators (with doors).

Note: For very large cargo hatches having widths in excess of 7.6 m (25 ft.), a supplementary standpipe sprinkling system should be provided. This open head system should be manually operated and consist of 30° and 80° fan type nozzles in accordance with NAVSEA Drawing number 803-1385828, located around the hatch perimeter to cover areas not protected by automatic sprinkling.

f.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

f.8. Group Criteria.

The sprinkling of a cargo handling deck shall be in a single group.

f.9. Firemain Supply.

- f.9.a. The supply source for the cargo handling deck sprinkling shall be taken from one segregation of the firemain.
- f.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-f.4., above and the number of sprinklers operating as specified in 522-2-f.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

f.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-f.12., below). Exceptions to this requirement shall be approved by NAVSEA.

f.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as a flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

f.12. Piping Arrangement.

f.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.

f.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).

f.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

f.13. Spares and Tools.

f.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.

f.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-f.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

f.14. System Alarm.

- f.14.a. A flow switch in accordance with MIL-S-16032, type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- f.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- f.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- f.14.d. The flow switch setting shall be 76 L/min (20 gpm).
- f.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

f.15. Preventive Maintenance.

- f.15.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system at each branch line to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- f.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- f.15.c. A pressure tap shall be installed immediately downstream of each control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
- f.15.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

f.16. Operational Provisions.

- f.16.a. Valve and system identification shall be provided as required in the applicable specifications.

f.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.

f.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

f.17. Deck Drainage.

The cargo handling deck shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2.g. Flammable Gas Cylinder Storeroom

g.1. Application Rate.

The water flow density for the sprinkled area shall be between 12.2 L/min/m² (0.30 gpm/ft²) and 20.4 L/min/m² (0.50 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-g.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-g.2., below).

g.2. Sprinkled Area. (See 522-2-g.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

g.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-g.6.k. and 522-2-g.6.m.)

g.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

g.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 20. It shall be assumed that the 20 sprinklers furthest from the supply header shall be actuated (the 20 sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 20 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

g.6. Nozzle Arrangement.

g.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the average application rate for the compartment does not exceed the maximum specified in

522-2-g.1., above. Sprinklers shall be placed to wet all flammable gas cylinders.

- g.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- g.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- g.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-g.6.c. shall apply.
- g.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- g.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- g.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- g.6.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- g.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- g.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.

g.12. Piping Arrangement.

- g.12.a.** Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- g.12.b.** The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- g.12.c.** Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

g.13. Spares and Tools.

- g.13.a.** A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- g.13.b.** A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-g.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

g.14. System Alarm.

- g.14.a.** A flow switch in accordance with MIL-S-16032, type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- g.14.b.** The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- g.14.c.** Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- g.14.d.** The flow switch setting shall be 76 L/min (20 gpm).
- g.14.e.** The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

g.15. Preventive Maintenance.

- g.15.a.** Flush-out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- g.15.b.** A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- g.15.c.** A pressure tap shall be installed immediately downstream of each group control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
- g.15.d.** Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

g.16. Operational Provisions.

- g.16.a.** Valve and system identification shall be provided as required in the applicable specifications.
- g.16.b.** A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
- g.16.c.** A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

g.17. Room Drainage.

The flammable gas cylinder storeroom shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-h. Carpenter Shop/Lumber Stowage

h.1. Application Rate.

The water flow density for the sprinkled area shall be between 8.1 L/min/m² (0.20 gpm/ft²) and 16.3 L/min/m² (0.40 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-h.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-h.2., below).

h.2. Sprinkled Area. (See 522-2-h.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

h.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-h.6.k. and 522-2-h.6.m.)

h.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

h.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 14. It shall be assumed that the 14 sprinklers furthest from the supply header shall be actuated (the ten sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 14 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

h.6. Nozzle Arrangement.

h.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the average application rate for the compartment does not exceed the maximum specified in

522-2-h.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- h.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- h.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- h.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-h.6.c. shall apply.
- h.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- h.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- h.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- h.g.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- h.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- h.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.

- h.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage. The sprinkler head shall be configured in a way to minimize the possibility of damage to the head from movement of lumber stored in the overhead. Upright sprinklers shall be used for these installations.
- h.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- h.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- h.6.n. Overhead Lumber Stowage Racks. For rooms with racks installed for storage of lumber in the overhead, sprinklers shall be located around the perimeter and within 0.3 m (1 ft.) of the racks spaced at intervals not to exceed 3.6 m (12 ft.). In addition, a sprinkler shall be installed above the racks for each 12.1 m² (130 ft²) of overhead stowage rack area.

h.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

h.8. Group Criteria.

The sprinkling of a carpenter shop/lumber stowage room shall be in a single group.

h.9. Firemain Supply.

h.9.a. The supply source for the carpenter shop/lumber stowage sprinkling shall be taken from one segregation of the firemain.

h.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-h.4., above and the number of sprinklers operating as specified in 522-2-h.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

h.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-h.12., below). Exceptions to this requirement shall be approved by NAVSEA.

h.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

h.12. Piping Arrangement.

h.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.

h.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).

h.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

h.13. Spares and Tools.

h.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.

h.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-h.13.a., above. The wrench shall be used for removal and installation of sprinklers for the system.

h.14. System Alarm.

h.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.

h.14.b. The alarm shall be indicated on a Mil-S-16032, Type IC/SM alarm switchboard in Damage Control Central.

- h.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- h.14.d. The flow switch setting shall be 76 L/min (20 gpm).
- h.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

h.15. Preventive Maintenance.

- h.15.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- h.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- h.15.c. A pressure tap shall be installed immediately downstream of each group control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
- h.15.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

h.16. Operational Provisions.

- h.16.a. Valve and system identification shall be provided as required in the applicable specifications.
- h.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
- h.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

h.17. Room Drainage.

The carpenter shop/lumber stowage compartment shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-i. Trash Compactor Room

i.1. Application Rate.

The water flow density for the sprinkled area shall be between 6.1 L/min/m² (0.15 gpm/ft²) and 12.2 L/min/m² (0.30 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-i.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-i.2., below).

i.2. Sprinkled Area. (See 522-2-i.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

i.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-i.6.k. and 522-2-i.6.m.)

i.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

i.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of ten. It shall be assumed that the ten sprinklers furthest from the supply header shall be actuated (the ten sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than ten sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

i.6. Nozzle Arrangement.

i.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the application rate for the compartment does not exceed the maximum specified in

522-2-i.6.1., above. Sprinklers need not be placed to wet all surfaces, but sprinkler spacing shall ensure that a fire would be contained.

- i.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- i.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1. For spaces with a drop or false ceiling, pendant type sprinklers shall be located beneath false or drop ceiling such as to provide as much overhead room as practical.
- i.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-i.6.c. shall apply. In the case of screened stowage areas, the requirements specified in 522-2-i.6.n shall apply.
- i.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- i.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- i.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- i.6.h. Sprinklers shall not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- i.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.

- i.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.
- i.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment.
- i.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- i.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- i.6.n. Screened Stowage Areas. Areas within the trash compactor room that are screened in for stowage of trash shall be provided with at least one sprinkler head within the screened area. Additional sprinklers shall be provided only for large areas where the spacing requirements in 522-2-i.6.a, above apply.

i.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

i.8. Group Criteria.

The sprinkling of a trash compactor room shall be in a single group.

i.9. Firemain Supply.

i.9.a. The supply source for trash compactor room sprinkling shall be taken from one segregation of the firemain.

i.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-i.4., above and the number of sprinklers operating as specified in 522-2-i.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

i.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-i.12., below). Exceptions to this requirement shall be approved by NAVSEA.

i.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

i.12. Piping Arrangement.

- i.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- i.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- i.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

i.13. Spares and Tools.

- i.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- i.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-i.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

i.14. System Alarm.

- i.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- i.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.

- i.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
 - i.14.d. The flow switch setting shall be 76 L/min (20 gpm).
 - i.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.
- i.15. Preventive Maintenance.
- i.15.a. Flush out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
 - i.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
 - i.15.c. A pressure tap shall be installed immediately downstream of the control valve. The pressure gage shall be installed for each tap outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
 - i.15.d. Flush out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.
- i.16. Operational Provisions.
- i.16.a. Valve and system identification shall be provided as required in the applicable specifications.
 - i.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
 - i.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open for sprinkling and showing the sprinkled area.
- i.17. Room Drainage.

The trash compactor room shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-j. Paint Spray Room and Paint Spray Booth

j.1. Application Rate.

The water flow density for the sprinkled area shall be between 16.3 L/min/m² (0.40 gpm/ft²) and 24.4 L/min/m² (0.60 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-j.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-j.2., below).

j.2. Sprinkled Area. (See 522-2-j.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

j.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-j.6.k. and 522-2-j.6.m.)

j.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

j.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 27. It shall be assumed that the 27 sprinklers furthest from the supply header shall be actuated (the 27 sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 27 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

j.6. Nozzle Arrangement.

j.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the average application rate for the compartment does not exceed the maximum specified in

522-2-j.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- j.6.b. Plenums and exhaust ducts. Pendant type sprinklers shall be located inside plenums and exhaust ducts. Inside exhaust ducts, sprinklers shall be located at the top of each vertical riser, at the midpoint of each vertical offset, and at the entrance to each horizontal duct. Additional sprinklers shall be located in the ducts, no less than 3.6 m (12 ft.) apart and not less than 1.5 m (5 ft.) from the duct entrance.
- j.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- j.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-j.6.c. shall apply.
- j.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- g.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- j.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- j.6.h. Sprinklers shall not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- j.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.

- j.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.
- j.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage.
- j.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- j.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- j.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.
- j.8. Group Criteria.

The sprinkling of a paint spray room or booth shall be in a single group.
- j.9. Firemain Supply.
 - j.9.a. The supply source for a paint spray room or booth sprinkling shall be taken from one segregation of the firemain.
 - j.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-j.4., above and the number of sprinklers operating as specified in 522-2-j.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.
- j.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-j.12., below). Exceptions to this requirement shall be approved by NAVSEA.

j.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

j.12. Piping Arrangement.

j.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.

j.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).

j.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

j.13. Spares and Tools.

j.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.

j.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-j.13.a., above. The wrench shall be used for removal and installation of sprinklers for the system.

j.14. System Alarm.

j.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.

j.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.

- j.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
 - j.14.d. The flow switch setting shall be 76 L/min (20 gpm).
 - j.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.
- j.15. Preventive Maintenance.
- j.15.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
 - j.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
 - j.15.c. A pressure tap shall be installed immediately downstream of each control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
 - j.15.d. Flush out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.
- j.16. Operational Provisions.
- j.16.a. Valve and system identification shall be provided as required in the applicable specifications.
 - j.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
 - j.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.
- j.17. Room Drainage.

Drainage capability shall be provided in accordance with Sections 528 and 529 of the General Specifications.

522-2-k. Aviation Tire Storeroom

k.1. Application Rate.

The water flow density for the sprinkled area shall be between 24.4 L/min/m² (0.60 gpm/ft²) and 36.7 L/min/m² (0.90 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-k.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-k.2., below).

k.2. Sprinkled Area. (See 522-2-k.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

k.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-k.6.k. and 522-2-k.6.m.)

k.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

k.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 41. It shall be assumed that the 41 sprinklers furthest from the supply header shall be actuated (the 41 sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 41 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

k.6. Nozzle Arrangement

k.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 2.4 m (8 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the average application rate for the compartment does not exceed the maximum specified in

522-2-k.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- k.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- k.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- k.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-k.6.c. shall apply.
- k.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- k.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- k.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- k.6.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- k.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- k.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.

k.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage.

k.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.

k.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.

k.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

k.8. Group Criteria.

The sprinkling of an aviation tire storeroom shall be in a single group.

k.9. Firemain Supply.

k.9.a. The supply source for the aviation tire storeroom sprinkling shall be taken from one segregation of the firemain.

k.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-k.4., above and the number of sprinklers operating as specified in 522-2-k.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

k.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-k.12., below). Exceptions to this requirement shall be approved by NAVSEA.

k.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

k.12. Piping Arrangement

- k.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- k.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- k.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

k.13. Spares and Tools.

- k.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- k.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-k.13.a., above. The wrench shall be used for removal and installation of sprinklers for the system.

k.14. System Alarm.

- k.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- k.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- k.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- k.14.d. The flow switch setting shall be 76 L/min (20 gpm).
- k.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

k.15. Preventive Maintenance.

- k.15.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- k.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- k.15.c. A pressure tap shall be installed immediately downstream of each control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
- k.15.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

k.16. Operational Provisions.

- k.16.a. Valve and system identification shall be provided as required in the applicable specifications.
- k.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
- k.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

k.17. Storeroom Drainage.

The aviation tire storeroom shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-1. Living Spaces

1.1. Application Rate.

The water flow density for the sprinkled area shall be between 6.1 L/min/m² (0.15 gpm/ft²) and 12.2 L/min/m² (0.30 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-1.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-1.2., below).

1.2. Sprinkled Area. (See 522-2-1.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

1.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-1.6.k. and 522-2-1.6.m.)

1.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

1.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of ten for one group. It shall be assumed that the ten sprinklers furthest from the supply header shall be actuated (the ten sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For groups which contain less than ten sprinklers, all sprinklers in the group shall be assumed to be flowing simultaneously.

1.6. Nozzle Arrangement.

1.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the average application rate for the compartment does not exceed the maximum specified in

522-2-1.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- 1.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- 1.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- 1.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-1.6.c. shall apply.
- 1.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- 1.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- 1.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- 1.6.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- 1.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- 1.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head for the purpose of replacement without removal of interference or supply piping.

1.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage. The sprinkler head shall be configured in a way to minimize the possibility of damage to the head. Upright sprinklers shall be used for these installations. Obstructions to sprinkler discharge shall be minimized.

1.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.

1.6.m. Pendant downlegs. If pendant sprinklers are used, the sprinkler shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.

1.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

1.8. Group Criteria.

The sprinkling of living spaces shall be arranged in groups with one sprinkling group for each level of living space.

1.9. Firemain Supply.

1.9.a. The supply source for each living space sprinkling group shall be taken from one segregation of the firemain.

1.9.b. The minimum required supply pressure for each group shall be calculated based on the minimum nozzle pressure specified in 522-2-1.4., above and the number of sprinklers operating as specified in 522-2-1.5., above. The calculated minimum required supply pressure for each group shall be less than 75% of the rated firemain pressure.

1.10. System Control.

The supply source for each group shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment (if feasible), adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-1.12., below). Exceptions to this requirement shall be approved by NAVSEA.

1.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage

control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

1.12. Piping Arrangement.

- 1.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- 1.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- 1.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

1.13. Spares and Tools.

- 1.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- 1.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-1.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers.

1.14. System Alarm.

- 1.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- 1.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- 1.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- 1.14.d. The flow switch setting shall be 76 L/min (20 gpm).

1.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

1.15. Preventive Maintenance.

1.15.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.

1.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.

1.15.c. A pressure tap shall be installed immediately downstream of each group control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.

1.15.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

1.16. Operational Provisions.

1.16.a. Valve and system identification shall be provided as required in the applicable specifications.

1.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.

1.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

1.17. Living Space Drainage.

Each living space shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-m. Vital Area Perimeter

m.1. Application Rate.

Not applicable for vital area perimeter sprinkling (see 522-2-m.6., below).

m.2. Sprinkled Area.

Not applicable for vital area perimeter sprinkling (see 522-2-m.6., below).

m.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-m.6.k. and 522-2-m.6.m.)

m.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

m.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of ten. It shall be assumed that the ten sprinklers furthest from the supply header shall be actuated (the ten sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than ten sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

m.6. Nozzle Arrangement.

m.6.a. Spacing. The sprinkler shall consist of a single line of sprinklers spaced no more than 4.6 m (15 ft.) apart and not more than 2.3 m (7-1/2 ft.) from the exterior perimeter of the protected area. Additional sprinklers shall be provided to compensate for blockage by bulkheads, access openings, and so forth, in order to provide coverage of the perimeter; however, additional sprinklers shall be placed such that the average spacing is not less than 3.0 m (10 ft.) around the perimeter. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

m.6.b. Cableway coverage. Sprinklers shall be located to provide the maximum coverage feasible for cableways while meeting other arrangement requirements.

m.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural

members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.

- m.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-m.6.c. shall apply.
 - m.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
 - m.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts) which are greater than 1220 mm (4 ft.) wide.
 - m.6.g. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
 - m.6.h. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
 - m.6.i. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.
 - m.6.j. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage.
 - m.6.k. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
 - m.6.l. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- m.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

m.8. Group Criteria.

The sprinkling of the perimeter of a vital complex or vital space shall be in a single group.

m.9. Firemain Supply.

m.9.a. The supply source shall be from at least two separate "ZEBRA" segregations of the firemain.

m.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-m.4., above and the number of sprinklers operating as specified in 522-2-m.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

m.10. System Control.

The supply source shall have a manual stop-check sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-m.12., below). Exceptions to this requirement shall be approved by NAVSEA.

m.11. Piping Arrangement.

m.11.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.

m.11.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).

m.11.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

m.12. Spares and Tools.

m.12.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.

- m.12.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-m.12.a., above. The wrench shall be used for removal and installation of sprinklers for the system.
- m.13. System Alarm.
 - m.13.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
 - m.13.b. The alarm shall be indicated on a Mil-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
 - m.13.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
 - m.13.d. The flow switch setting shall be 76 L/min (20 gpm).
 - m.13.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.
- m.14. Preventive Maintenance.
 - m.14.a. Flush-out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
 - m.14.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
 - m.14.c. A pressure tap shall be installed immediately downstream of each group control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
 - m.14.d. Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

m.15. Operational Provisions.

m.15.a. Valve and system identification shall be provided as required in the applicable specifications.

m.15.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.

m.15.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

m.16. Vital Area Perimeter Drainage.

The vital area perimeter shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-n. Solid and Plastic Waste Reprocessing Room

n.1. Application Rate.

The water flow density for the sprinkled area shall be between 8.1 L/min/m² (0.20 gpm/ft²) and 16.3 L/min/m² (0.40 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-n.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-n.2., below).

n.2. Sprinkled Area. (See 522-2-n.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

n.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-n.6.k. and 522-2-n.6.m.)

n.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

n.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 14. It shall be assumed that the 14 sprinklers furthest from the supply header shall be actuated (the 14 sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 14 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

n.6. Nozzle Arrangement.

n.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the application rate for the compartment does not exceed the maximum specified in

522-2-n.1., above. Sprinklers need not be placed to wet all surfaces, but sprinkler spacing shall ensure that a fire would be contained.

- n.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- n.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1. For spaces with a drop or false ceiling, pendant type sprinklers shall be located beneath false or drop ceiling such as to provide as much overhead room as practical.
- n.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-n.6.c. shall apply. In the case of screened stowage areas, the requirements specified in 522-2-n.6.n shall apply.
- n.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- n.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- n.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- n.6.h. Sprinklers shall not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- n.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.

- n.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.
- n.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment.
- n.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- n.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.
- n.6.n. Screened Stowage Areas. Areas within the plastic waste reprocessing room that are screened in for stowage of trash shall be provided with at least one sprinkler head within the screened area. Additional sprinklers shall be provided only for large areas where the spacing requirements in 522-2-n.6.a, above apply.
- n.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.
- n.8. Group Criteria.

The sprinkling of a solid and plastic waste reprocessing room shall be in a single group.
- n.9. Firemain Supply.
 - n.9.a. The supply source for solid and plastic waste reprocessing room sprinkling shall be taken from one segregation of the firemain.
 - n.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-n.4., above and the number of sprinklers operating as specified in 522-2-n.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.
- n.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve) with a locking device. The control valve shall be outside the protected compartment, adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-n.12., below). Exceptions to this requirement shall be approved by NAVSEA.

n.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

n.12. Piping Arrangement.

n.12.a. Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.

n.12.b. The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).

n.12.c. Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

n.13. Spares and Tools.

n.13.a. A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.

n.13.b. A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-n.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

n.14. System Alarm.

n.14.a. A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.

n.14.b. The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.

- n.14.c. Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
 - n.14.d. The flow switch setting shall be 76 L/min (20 gpm).
 - n.14.e. The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.
- n.15. Preventive Maintenance.
- n.15.a. Flush out connections shall be provided at the most remote portions of the sprinkler system to provide flushing of the sprinkler system supply main and sprinkler branches. The flush out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
 - n.15.b. A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
 - n.15.c. A pressure tap shall be installed immediately downstream of the control valve. The pressure gage shall be installed for each tap outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
 - n.15.d. Flush out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.
- n.16. Operational Provisions.
- n.16.a. Valve and system identification shall be provided as required in the applicable specifications.
 - n.16.b. A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
 - n.16.c. A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open for sprinkling and showing the sprinkled area.
- n.17. Room Drainage.

The solid and plastic waste reprocessing room shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

522-2-o. Rubber and Plastic Shop

o.1. Application Rate.

The water flow density for the sprinkled area shall be between 16.3 L/min/m² (0.40 gpm/ft²) and 24.4 L/min/m² (0.60 gpm/ft²). The application rate shall be calculated by multiplying the total number of sprinklers (located in accordance with 522-2-o.6., below) by 83 L/min (22 gpm) and dividing the result by the sprinkled area (see 522-2-o.2., below).

o.2. Sprinkled Area. (See 522-2-o.6., below.)

Determination of the total sprinkled area shall be based on calculation of the total square meters of deck area (including equipment area). For compartments/ spaces with non-vertical bulkheads, the determination of the total sprinkled area shall be based on the larger of the overhead area or the deck area.

o.3. Type of Sprinkler Head.

The sprinkler head shall conform to MIL-S-24686, rated at 79°C (175°F). Sprinklers shall be installed in the upright configuration. Where design requirements cannot be met due to physical interferences, the pendant sprinkler configuration may be used. Upright sprinklers should be used whenever possible. (See 522-2-o.6.k. and 522-2-o.6.m.)

o.4. Sprinkler Head Orifice Size and Minimum Nozzle Pressure.

The sprinkler shall be sized at 13 mm (1/2 in.) and the minimum system pressure provided to the most remote head shall be 103 kPa (15 lb/in²).

o.5. Number of Sprinklers Flowing.

For the purpose of a hydraulic calculation, the total number of sprinklers flowing at one time shall be assumed to be a maximum of 27. It shall be assumed that the 27 sprinklers furthest from the supply header shall be actuated (the 27 sprinklers which result in the largest pressure drop to the nozzles should be assumed to be actuated). For spaces which contain less than 27 sprinklers, all sprinklers in the space shall be assumed to be flowing simultaneously.

o.6. Nozzle Arrangement.

o.6.a. Spacing. Sprinkler heads shall be uniformly spaced to provide coverage throughout the protected area. The maximum distance between sprinklers shall be 3.6 m (12 ft.). Additional sprinklers shall be provided to compensate for blockage by bulkheads, partitions, hatches, ladders, and so forth. The distance from sprinklers to bulkheads (or partitions) shall not exceed 1.8 m (6 ft.). Placement of additional sprinklers shall be accomplished such that the

application rate for the compartment does not exceed the maximum specified 522-2-o.2.1., above. Sprinklers need not be placed to wet all surfaces but sprinkler coverage shall ensure that a fire would be contained.

- o.6.b. Cableway coverage. Sprinkling coverage of overhead cableways shall not be included in the design of the sprinkling system.
- o.6.c. Sprinkler elevation. The sprinkler deflector shall be located within 150 mm (6 in.) of the overhead. If it is necessary to locate the sprinkler under structural members, the sprinkler deflector shall be located 25 to 150 mm (1 to 6 in.) below the structural member. If it is necessary to locate sprinklers between structural members in the overhead, the maximum allowable distances of the deflectors above the bottom of the structural members shall be as shown in Table 1.
- o.6.d. Obstructions to the discharge. Vertical obstructions to sprinkler discharge (such as stanchions, vertical ducts, vertical pipes, etc.) shall have an absolute minimum separation distance between the sprinkler and the obstruction of three times the width of the obstruction, and a preferred minimum separation distance between the sprinkler and the obstruction of six times the width of the obstruction. Where it is not feasible to meet the above requirements due to close proximity of equipment or ships structures, sprinklers separated from vertical obstructions by a distance of 915 mm (3 ft.) or more shall be considered as meeting the intent of this requirement, irrespective of the width of the vertical obstruction. In the case of horizontal obstructions, the requirements specified in 522-2-o.6.c. shall apply.
- o.6.e. Minimum separation. Sprinklers shall be arranged to prevent operating sprinklers from wetting adjacent sprinklers, thus delaying or preventing their operation.
- o.6.f. Sprinklers under obstructions. Sprinklers shall be installed under obstructions (such as large ducts and cable trays) which are greater than 1220 mm (4 ft.) wide.
- o.6.g. Clear space below sprinklers. At least 460 mm (18 in.) of clear space shall be maintained below sprinkler deflectors.
- o.6.h. Sprinklers shall be not be located within 100 mm (4 in.) of a bulkhead or similar partition.
- o.6.i. Deflector orientation. Deflectors of upright and pendant sprinklers shall be parallel to the overhead.
- o.6.j. Maintenance Access. The arrangement shall permit access to each sprinkler head without removal of interference or supply piping.

- o.6.k. Interference. The arrangement shall assure that sprinklers do not interfere with the passage of personnel or equipment, and that sprinklers do not interfere with access to equipment or storage.
- o.6.l. Prohibition of loop. Sprinklers shall not be arranged in a closed loop.
- o.6.m. Pendant downlegs. Pendant sprinklers shall be installed using a return bend design of the downleg pipe, as shown in Figure 1.

o.7. Type of System.

The sprinkler system shall be a wet type, pressurized from the firemain.

o.8. Group Criteria.

The sprinkling of the rubber and plastic shop shall be in a single group.

o.9. Firemain Supply.

o.9.a. The supply source for rubber and plastic shop sprinkling shall be taken from one segregation of the firemain.

o.9.b. The minimum required supply pressure shall be calculated based on the minimum nozzle pressure specified in 522-2-o.4., above and the number of sprinklers operating as specified in 522-2-o.5., above. The calculated minimum required supply pressure shall be less than 75% of the rated firemain pressure.

o.10. System Control.

The supply source shall have a manual sprinkler control valve (such as a gate, globe, or ball valve). The sprinkler control valve shall have a locking device unless the valve has a remote operator. The control valve shall be outside the protected compartment adjacent to the access to the compartment, and shall be accessible within the same watertight boundary as the access to the compartment. The control valve shall be physically accessible, installed in a zone between 1.2 m (4 ft.) and 2.0 m (6 ft. 6 in.) above the deck level, and permit free passage in walking areas (see 522-2-o.12., below). Exceptions to this requirement shall be approved by NAVSEA.

o.11. Remote Isolation Capability.

The system shall include a capability which permits personnel on the damage control deck to isolate the supply source for systems located below the damage control deck. This function may be achieved by locating the firemain root isolation valve on the damage control deck. Alternatively, a manual mechanical remote operator such as a flexible cable for the control valve may be used for this function. A manual remote operator, if used, shall be located on the damage control deck. Exceptions to this requirement shall be approved by NAVSEA.

o.12. Piping Arrangement.

- o.12.a.** Piping (including fittings and valves) shall be arranged to permit free passage in walking areas (i.e., 1955 mm (6 ft. 5 in.) clear deck and 760 mm (30 in.) wide passageway), shall be arranged to permit the performance of all normal and emergency operations in designated working areas, and shall not interfere with the operation or control of machinery and equipment.
- o.12.b.** The piping shall be arranged to avoid unnecessary high and low points. Where necessary, vents and drains shall be installed with valves at least 13 mm (1/2 in.).
- o.12.c.** Piping shall be designed to minimize the number of valves required for equipment isolation and damage control.

o.13. Spares and Tools.

- o.13.a.** A stock of spare sprinklers shall be provided in a cabinet located where the temperature will not exceed 38°C (100°F). The cabinet shall be located in a repair locker. The cabinet shall include spares for not less than two sprinklers of each type, plus ten percent of the total number of each type of sprinkler installed in the zone served by that repair locker.
- o.13.b.** A special sprinkler wrench shall be provided in the same cabinet specified in 522-2-o.13.a., above. The wrench shall be designated for use in removal and installation of sprinklers for the system.

o.14. System Alarm.

- o.14.a.** A flow switch in accordance with MIL-S-16032, Type IC/FS (thermal dispersion type) shall be installed outside the protected space in the line immediately downstream of the control valve. The flow switch shall energize alarm signals when there is flow of water in the piping line.
- o.14.b.** The alarm shall be indicated on a MIL-S-16032, Type IC/SM alarm switchboard in Damage Control Central.
- o.14.c.** Flow of water shall close the flow switch which will energize a single-pole relay installed in the vicinity of the flow switch. Operation of the relay shall close the relay contacts to energize alarm signals.
- o.14.d.** The flow switch setting shall be 76 L/min (20 gpm).
- o.14.e.** The power source for the flow switch and relay shall be a local emergency lighting distribution box. The power source for the relay auxiliary contacts shall be the alarm switchboard.

o.15. Preventive Maintenance.

- o.15.a.** Flush-out connections shall be provided at the most remote portions of the sprinkler system at each branch line to provide flushing of the sprinkler system supply main and sprinkler branches. The flush-out connections shall terminate at a Navy standard line tester and flushing connection, or equal.
- o.15.b.** A flushing connection shall be provided at the supply to the sprinkler system immediately upstream of the control valve. The flushing connection shall be a 38 mm (1-1/2 in.) valve and a 38 mm (1-1/2 in.) hose connection located on the bottom of a horizontal pipe. Clearance shall be provided for attachment of a fire hose to the hose connection.
- o.15.c.** A pressure tap shall be installed immediately downstream of each control valve. A pressure gage shall be installed for each tap. Each gage shall be located outside the protected space. The gage connection shall include a cutout valve and gage test connection in accordance with Navy Standard Drawing number 803-1385850.
- o.15.d.** Flush-out connections, flow test fittings and pressure gages shall not be located in vital spaces or voids. They shall be accessible for periodic use.

o.16. Operational Provisions.

- o.16.a.** Valve and system identification shall be provided as required in the applicable specifications.
- o.16.b.** A label plate shall be installed near the FH alarm panel showing the sprinkled area and the location of the cutout valves.
- o.16.c.** A label plate shall be installed at the sprinkling control valve cautioning that valve must remain open and showing the sprinkled area.

o.17. Shop Drainage.

The rubber and plastic shop shall have drainage capability in accordance with Sections 528 and 529 of the General Specifications.

| Distance from Sprinkler to Side of Structural Member | Maximum Allowable Distance of Deflector Above Bottom of Structural Member |
|---|--|
| Less than 305 mm (1 ft.) | 0 mm (0 in.) |
| 305 mm (1 ft.) to less than 610 mm (2 ft.) | 25 mm (1 in.) |
| 610 mm (2 ft.) to less than 760 mm (2 ft. 6 in.) | 50 mm (2 in.) |
| 760 mm (2 ft. 6 in.) to less than 915 mm (3 ft.) | 75 mm (3 in.) |
| 915 mm (3 ft.) to less than 1070 mm (3 ft. 6 in.) | 100 mm (4 in.) |
| 1070 mm (3 ft. 6 in.) to less than 1220 mm (4 ft.) | 150 mm (6 in.) |
| 1220 mm (4 ft.) to less than 1370 mm (4 ft. 6 in.) | 180 mm (7 in.) |
| 1370 mm (4 ft. 6 in.) to less than 1525 mm (5 ft.) | 230 mm (9 in.) |
| 1525 mm (5 ft.) to less than 1675 (5 ft. 6 in.) | 280 mm (11 in.) |
| 1675 mm (5 ft. 6 in.) to less than 1830 mm (6 ft.) | 355 mm (14 in.) |

Table 1 - Sprinkler Deflector Clearance

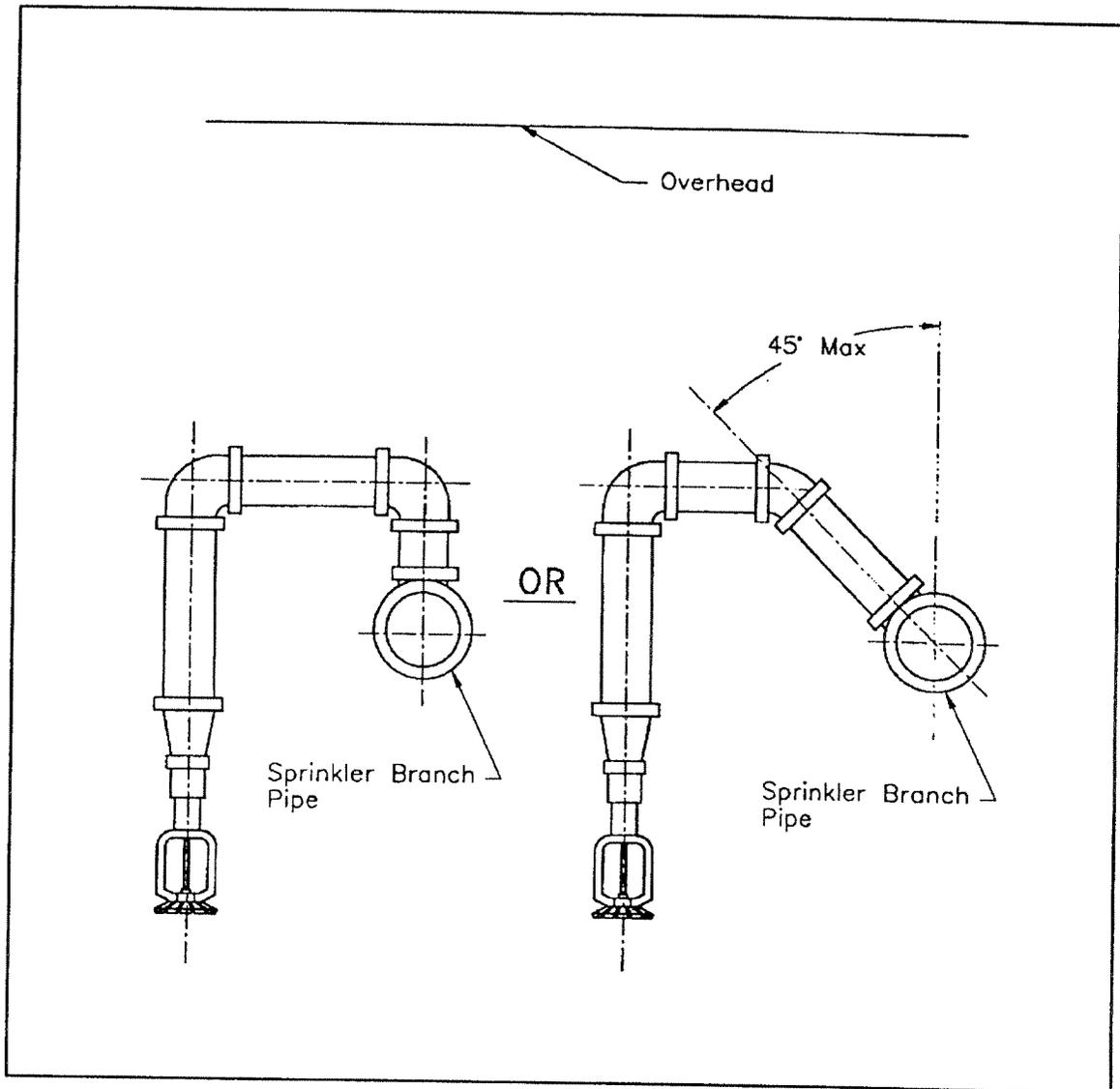


Figure 1. Configuration of Pendant Downlegs