Preparing Activity: NAVFAC Superseding
UFGS-21 22 00.00 20 (November 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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DIVISION 21 - FIRE SUPPRESSION

SECTION 21 22 00.00 20

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05/11

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SECTION 21 22 00.00 20

HALON 1301 FIRE EXTINGUISHING
05/11

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NOTE: This guide specification covers the requirements for Halon 1301 fire extinguishing systems for protection of data processing equipment and similar electronics occupancies.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
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NOTE: Use of this guide specification requires a waiver in accordance with NAVFAC Ozone Depleting Substances (ODS) Procurement Policy and Procedures with the approval of a Senior Acquisition Officer (SAO). With minor changes, this guide can be adapted to other occupancies or needs, such as the protection of electric generators and flight simulators. The extent and location of the work to be accomplished, and the type of electric service, cables, wire, conduit, location of storage cylinders, actuating stations, control panels, storage batteries, battery chargers, and accessories indicated, specified, or necessary for the complete installation required shall be indicated on the project drawings. If there are questions concerning

system design, the cognizant Engineering Field Division Fire Protection Engineer should be consulted. Due to the toxicity of decomposed Halon, an engineered smoke and Halon removal system (not part of this specification) will be required for each protected space. Such a system shall be manually key operated, for fire department use only. See also NFPA 12A section on relief venting.

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NOTE: The following information should be shown on the drawings:

1. On the electrical power floor plans show locations of control panel, annunciator(s), audible and visual alarm devices, manual actuation stations, point of connection to the building fire evacuation alarm system, remote trouble device, and point of connection to the incoming power supply and fusible safety switch. Do not show conduit sizes or number of conductors for DC circuits. Do not show locations of smoke detectors.

2. Show single line riser diagram for all detection, activation, and alarm circuits. Connection of equipment shall be indicated by circuit runs and not conduit runs. Do not indicate number and size of conductors for interconnection of fire alarm components.

3. On the mechanical floor plans, show locations for Halon storage containers. Show areas of system coverage, with zone designations (if multiple zones). Do not show Halon piping layout and nozzle placement.

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project

specification when you choose to reconcile references in the publish print process.
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.11	(2022) Forged Fittings, Socket-Welding and Threaded

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2022) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A106/A106M	(2019a) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-69	(2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 12A	(2022) Standard on Halon 1301 Fire Extinguishing Systems
NFPA 70	(2023) National Electrical Code
NFPA 72	(2022; ERTA 22-1) National Fire Alarm and Signaling Code
NFPA 75	(2020) Standard for the Protection of Information Technology Equipment
NFPA 90A	(2024) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-2962	(Rev A; Notice 2) Enamel, Alkyd, Gloss, Low VOC Content
CID A-A-58092	(Basic; Notice 1; Notice 2) Tape, Antiseize, Polytetrafluoroethylene
FS TT-P-645	(Rev C; Notice 1) Primer, Paint, Zinc-Molybdate, Alkyd Type

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.2.1 Description of Work

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NOTE: Identify the rooms, spaces or areas, as appropriate, which are to be protected by each type of system.

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The work includes the designing and providing of approved Halon 1301 underfloor [and room] flooding extinguishing system(s) for protection of [_____]. The design, equipment, materials, installation and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 12A, except as modified herein. Each system shall include all materials, accessories and equipment inside and outside the building necessary to provide each system complete and ready for use. Design and install each system to give full consideration to built-in spaces, piping, electrical equipment, ductwork and all other construction and equipment and to be free from operating and maintenance difficulties, all in accordance with detailed drawings to be submitted to the Contracting Officer for approval. Devices and equipment for fire protection service shall be of a make and type listed by the Underwriter's Laboratories, Inc., or approved by the Factory Mutual System. In the publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the [_____] Division Fire Protection Engineer.

1.3 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals

required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.
****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[The fire protection engineer, [_____] Division, Naval Facilities Engineering Systems Command will review any approve all submittals in this section requiring Government approval.]

****
NOTE: For projects administered by the Pacific Division, Naval Facilities Engineering Systems Command, use the optional "SUBMITTALS" article immediately below and delete the general "SUBMITTALS" article above for Navy projects.
****

[The [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer delegates the authority to the Quality Control (QC) Representative's U.S. Registered Fire Protection Engineer for review and approval of submittals required by this section. Submit to the [_____] Division, Naval Facilities Engineering Systems Command, Fire Protection Engineer one set of all approved submittals and drawings immediately after approval but no more later than 15 working days prior to final inspection.]

SD-02 Shop Drawings

Halon System Piping Layout; G[, [_____]]

Field Wiring Diagrams; G[, [_____]]

SD-03 Product Data

Storage Cylinders; G[, [_____]]

Discharge Heads; G[, [_____]]

Manifolds; G[, [_____]]

Valves; G[, [_____]]

Discharge Nozzles; G[, [_____]]

Pipe; G[, [_____]]

Pipe Hangers and Supports; G[, [_____]]

Control Panel; G[, [_____]]

Manual Actuation Stations; G[, [_____]]

Pressure Switches; G[, [_____]]

Storage Batteries; G[, [_____]]

Smoke Detectors; G[, [_____]]

Audible Alarms; G[, [_____]]

Visual Alarms; G[, [_____]]

Annunciator Panels; G[, [_____]]

Electromagnetic Door Holder Release; G[, [_____]]

Battery Charger; G[, [_____]]

Fittings; G[, [_____]]

SD-05 Design Data

Halon Discharge Calculations; G[, [_____]]

Battery Capacity Calculations; G[, [_____]]

SD-07 Certificates

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NOTE: The qualifications clause in this guide specification has been approved by NAVFACENGCOMHQ in accordance with the requirements of Naval Facilities Acquisition Supplement (NFAS). NFAS can be found at the following link:
https://portal.navfac.navy.mil/portal/

page/portal/navfac/navfac_forbusinesses_pp/smallbusiness/contracting/navfac. **The paragraph in this guide specification may be used without any other NAVFACHQ approval or request for waiver.**
****

Record of Prior Installations; G[, [_____]]

Halon Fire Extinguishing System; G[, [_____]]

SD-10 Operation and Maintenance Data

Halon Fire Extinguishing System, Data Package 3; G[, [_____]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Remote Control Station Operating Instructions; G[, [_____]]

Record Drawings; G[, [_____]]

1.4 QUALITY ASSURANCE

****
NOTE: The qualifications clause in this guide specification has been approved by NAVFACHQ in accordance with the requirements of Naval Facilities Acquisition Supplement (NFAS). NFAS can be found at the following link: https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_forbusinesses_pp/smallbusiness/contracting/navfac. **The paragraph in this guide specification may be used without any other NAVFACHQ approval or request for waiver.**
****

1.4.1 Record of Prior Installations

Prior to installation, submit data showing of Halon fire extinguishing systems of the same type and design as specified herein. The data shall include the names and locations of at least two locations where the Contractor has installed such systems. The Contractor shall indicate the type and design of these systems and certify that these systems have performed satisfactorily in the manner intended for a period of not less than 18 months.

****
NOTE: For projects administered by the Pacific Division, Naval Facilities Engineering Systems Command, include the following optional paragraph requiring the minimum qualification of a NICET Level-III technician for preparation of all fire protection system drawings.
****

[Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of,

an individual who is experienced with the types of works specified herein, and is currently certified by the National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level-III certification in Special Hazard System program. Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

] Contractor shall have successfully installed Halon fire extinguishing systems of the same type and design as specified herein.

1.4.2 Halon Fire Extinguishing System

When preliminary field tests have been completed and all necessary corrections made, submit to the Contracting Officer a signed and dated letter attesting to the satisfactory completion of testing and stating that the systems is in operating condition. The letter shall include a written request for a formal inspection and test.

1.4.3 Manufacturer's Representative

Provide the services of a manufacturer's authorized representative or technician, experienced in the installation and operation of the type of system being provided to supervise the installation and testing, including final testing, adjustment of the system and to provide instruction to Government personnel.

1.5 DESIGN OF HALON FIRE EXTINGUISHING SYSTEMS

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NOTE: Delete reference to NFPA 75 only if the protected space(s) contain no automatic data processing requirement.

****

Design and installation of Halon fire extinguishing systems shall conform to NFPA 12A, NFPA 70, NFPA 72, [and NFPA 75] and to the requirements as hereinafter specified.

1.5.1 Piping Layout and Wiring Diagrams

Annotate halon system piping layout with reference points for design. In field wiring diagrams, show locations of devices and points of the system. Prepare working drawings on sheets not smaller than A0 1189 by 841 mm 30 by 42 inches, in accordance with the requirements for "Plans" as specified in NFPA 12A. Include data essential to the proper installation of each system.

1.5.2 Calculations

Submit halon discharge calculations verifying total storage requirements, flooding concentrations, discharge times, flow through the piping network, pipe sizes, and nozzle orifice sizes, in accordance with the manufacturer's listed design manual and NFPA 12A. Submit substantiating battery capacity calculations showing capacity, supervisory and alarm power requirements.

1.5.3 Flooding Concentration

The system shall totally flood the protected area(s) providing a volumetric concentration of Halon 1301 of not less than 5 percent nor more than 7 percent at 21 degrees C 70 degrees F.

1.5.3.1 Halon Concentration

The Halon concentration shall be based upon shutting down the heating, ventilation and air conditioning (HVAC) systems at the time of agent discharge. The required Halon concentration shall be maintained in the protected area(s) for a minimum of ten minutes.

1.5.4 Discharge Time

The maximum Halon liquid discharge time shall be 10 seconds.

1.5.5 Reserve Supplies

Each system shall be provided with its own connected reserve supply of Halon 1301. Each reserve supply shall contain an amount of Halon 1301 equal to the primary supply of the system to which it is connected.

1.5.6 Record Drawings

Upon completion, and before final acceptance of the work, submit a complete set of as-built (record) working drawings, [including complete as-built circuit diagrams,] of each Halon 1301 system for record purposes. The as-built working drawings shall be not smaller than A0 1189 by 841 mm 30 by 42 inches reproducible drawings on mylar film with title block (200 by 100 mm 8 by 4 inches) similar to full size contract drawings. The as-built working drawings shall be furnished in addition to the record drawings required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6 SYSTEM CONTROL

Provide all apparatus, accessories, components and associated materials specified or necessary to furnish each system complete and ready for operation. All equipment shall be the current products of their manufacturers.

1.6.1 Controls

Detection and actuating control system shall be complete, Class A electrically supervised combination automatic and manual. Automatic actuation shall be accomplished by smoke detectors. Manual actuation shall be accomplished by electrical manual actuation stations.

1.6.2 Sequence of Operation

Smoke detection system shall be cross-zoned, priority matrix, or have common circuit individual detector verification capability. If a cross-zoned system is used, each protected area shall contain two smoke detection circuits (zones), with each circuit having an equal number of detectors connected thereto and no two adjacent detectors connected to the same zone. Upon activation of any smoke detector, the system shall simultaneously activate pre-discharge alarms in the protected area(s), signal the building fire alarm control panel(s) to activate the building fire evacuation alarms, and send a signal to the base fire department via

the base fire alarm system. Upon activation of a second detector (on the opposite zone of a cross-zoned system), the systems shall immediately shut down [computer] [_____] equipment and air conditioning power, close all fire dampers [release all doors to permit closing] activate the discharge alarms, and initiate an adjustable 0-60 second time delay. At the end of the time delay, Halon shall discharge into the protected area[and post-discharge visual alarms shall activate].

1.6.2.1 Activation By Manual Station

Upon activation by a manual station, the system shall immediately perform all the above listed alarm functions and shut-down functions, and initiate the adjustable time delay. At the end of the delay, Halon shall discharge into the protected area.

[1.6.2.2 Manual Activation of Inhibit Switch

****
NOTE: Inhibit switches are optional devices which decrease system reliability and shall not be used without approval of the Division Fire Protection Engineer.
****

Upon manual activation of the inhibit switch, equipment shutdown and agent discharge shall be delayed. All other functions shall continue unimpeded. Upon release of inhibit switch, shutdown and discharge functions shall resume. Time delay shall not reset and shall resume countdown to discharge after release of switch.

]1.6.3 Transfer to reserve supply

Transfer from system main supply to reserve supply shall be controlled by a "main-reserve" switch at the system control panel.

1.6.4 Remote Control Station Operating Instructions

Submit the proposed legend for remote control station operating instructions.

PART 2 PRODUCTS

2.1 PIPING

Conceal piping to the maximum extent possible. Piping shall be inspected, tested and approved before being concealed. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through standard reducing pipe fittings; the use of bushings is not permitted.

2.1.1 Pipe

ASTM A53/A53M or ASTM A106/A106M, black or zinc-coated, threaded, Schedule 40.

2.1.2 Fittings

ASME B16.11 or ASME B16.3, Class 300, zinc-coated, threaded, except Class 150 or 300 for pipe 20 mm 3/4 inch or smaller.

2.1.3 Pipe Hangers and Supports

MSS SP-58 and MSS SP-69, adjustable type. Rods, hangers and supports shall be zinc plated. Provide pipe hangers and supports as follows:

Nominal Pipe Size (mm)	Maximum Spacing (meters)
25 and under	2.00
32	2.50
40	2.75
50	3.00
65	3.25
80	3.75
90	4.00
100	4.25
125	4.50
150	5.00

Nominal Pipe Size (inches)	Maximum Spacing (feet)
1 and under	7
1.25	8
1.5	9
2	10
2.5	11
3	12
3.5	13
4	14
5	15
6	16

2.1.4 Pipe Sleeves

Provide where piping passes through masonry or concrete walls, floors, roofs and partitions. Sleeves in outside walls below and above grade, in floor, and in roof slabs, shall be standard weight zinc coated steel pipe. Sleeves in partitions shall be zinc coated sheet steel having a nominal weight of not less than 4.40 kg per sq meters 0.90 pounds per square foot. Space between piping and the sleeve, shall be not less than 13 mm 0.5 inch. Sleeves shall be of sufficient length to pass through the entire thickness of walls, partitions and slabs. Extend sleeves in floor slabs 50 mm 2 inches above the finished floor. Pack space between the pipe and sleeve with asbestos free insulation and caulk at both ends of the sleeve with plastic waterproof cement.

2.1.5 Escutcheon Plates

Provide piping passing through floors, walls and ceilings with one piece or split type plates. Plates where pipe passes through finished ceilings shall be chromium plated. Other plates shall be of steel or cast iron, with aluminum paint finish. Securely anchor plates in place.

2.1.6 Discharge Nozzles

Fabricated of corrosion resistant materials. All nozzles shall be designed so that the orifice piece is connected directly to the supply pipe. The size of pipe and nozzles shall be determined from the calculated flow and terminal pressures in accordance with established, recognized test data contained in the manufacturer's listed design manual.

2.1.7 Storage Cylinders

Constructed of high strength alloy steel, conforming to all applicable specifications of the Department of Transportation. Container design shall permit on-site reconditioning and refilling when required. Safety valves, manifolds, pressure gauges, and pressure switches shall be provided.

2.1.8 Jointing Compound

Tape conforming to CID A-A-58092.

2.2 CONTROL PANEL

Provide complete electrical supervision of all circuits. Install modular type panel in a [flush] [surface] mounted steel cabinet with hinged door and cylinder lock. Switches and other controls shall not be accessible without the use of a key. The control panel shall be a neat, compact, factory-wired assembly containing all parts and equipment required to provide specified operating and supervisory functions of the system. Panel cabinet shall be finished on the inside and outside with factory-applied enamel finish. [Provide separate alarm and trouble lamps located on the exterior of the cabinet door or visible through the cabinet door for each zone initiating circuit.] Provide prominent rigid plastic or metal identification plates for all lamps and switches. A single open or ground fault condition in any detection or actuation circuit shall not result in any loss of system function, but shall cause the actuation of system trouble signals. A ground fault condition or single break in any other circuit shall result in the activation of the system trouble signals. [Supervision of wiring external to the control panel for

mechanical equipment shutdown is not required, provided a break in such wiring will cause the associated mechanical equipment to shut down.] Loss of AC power, a break in the standby battery power circuits, or abnormally low battery voltage shall also result in the operation of the system trouble signals. The abnormal position of any system switch in the control panel shall also result in the operation of the system trouble signals. Trouble signals shall operate continuously until the system has been restored to normal at the control panel. Provide a 100 mm 4 inch remote system trouble bell, installed [in a constantly attended area] [where shown], arranged to operate in conjunction with the integral trouble signals of the panel. Provide remote bell with a rigid plastic or metal identification sign which reads "Halon System Trouble." Lettering on identification sign shall be a minimum of 25 mm one inch high. Panel shall be provided with the following switches:

a. Trouble silencing switch which transfers trouble signals to an indicating lamp. Upon correction of the trouble condition, audible signals will again sound until the switch is returned to its normal position, or the trouble circuit shall be automatically restored to normal upon correction of the trouble condition.

b. Evacuation alarm silence switch which when activated will silence all alarm devices and cause operation of system trouble signals.

[c. [Master box]Disconnect switch which when activated will disconnect the system from the base fire alarm system and cause operation of the Halon system trouble signals.

] System control panel shall be UL Fire Prot Dir listed or FM APP GUIDE approved for extinguishing system control (releasing device service).

2.3 SECONDARY POWER SUPPLY

Supply shall include nickel cadmium, lead calcium or sealed lead acid batteries and charger. Drycell batteries are not allowed. House batteries in a well constructed steel cabinet with cylinder lock.

2.3.1 Storage Batteries

Provide batteries of adequate ampere-hour rating to operate the system under supervisory conditions for 60 hours at the end of which time batteries shall be capable of operating the entire system in a full alarm condition for not less than 30 minutes. Provide calculations substantiating the battery capacity. Provide reliable separation between cells to prevent contact between terminals of adjacent cells and between battery terminals and other metal parts.

2.3.2 Battery Charger

Provide completely automatic high/low charging rate type charger capable of recovery of the batteries from full discharge to full charge in 24 hours or less. Provide an ammeter for recording rate of charge and a voltmeter to indicate the state of battery charge. Provide a red pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high-rate switch is provided.

2.4 MANUAL ACTUATION STATIONS

****

NOTE: Where there is no room flooding or no raised floor space, omit requirement for separate actuation stations.

****

Provide actuation stations for systems at the exits from the protected areas. Operation of a manual station shall cause the control panel to go into full alarm condition and discharge Halon into the protected area following the adjustable time delay. [Provide separate, clearly labeled, manual stations for control of underfloor discharge and room flooding.] Stations shall be of a type not subject to operation by jarring or vibration. Stations shall have a dual action release configuration to prevent accidental system discharge. Break-glass-front stations are not permitted; however a pull lever break-glass-rod type is acceptable. Station color shall be red or orange. Warning signs shall be placed at each station indicating that operation of the station will cause immediate Halon discharge. Where building fire alarm pull stations are also mounted at the exits from the protected areas, they shall be separated from Halon actuation stations by at least one meter 3 feet horizontally, labels shall be provided to clearly distinguish building fire alarm stations from Halon stations and stations shall be of different colors.

2.5 SMOKE DETECTORS

Designed for detection of abnormal smoke densities by the [ionization] [photoelectric] principle. Necessary control and/or power modules required for operation of the device shall be integral with the main control panel. Detectors shall be compatible with main control panel provided and shall be suitable for use in a supervised circuit. Detectors shall not draw power from the initiating circuit. Operating power shall be taken from a separate supervised power supply circuit. Malfunction of the electrical circuitry to the detector or its control or power units shall result in the operation of the system trouble devices. Detectors shall not be susceptible to operation by changes in relative humidity. Each detector shall contain a visible indicator lamp that shall show when the unit is activated. Each detector shall be the plug-in type in which the detector base contains screw terminals for making all wiring connections. Remote indicator lamp shall be provided for each detector that is located above suspended ceilings, beneath raised floors or otherwise concealed from view.

2.5.1 Ionization Detectors

Multiple chamber type which is responsive to both visible and invisible products of combustion. The sensitivity of each detector shall be field adjustable to compensate for the conditions under which it is to operate.

2.5.2 Photoelectric Detectors

Operate on a multiple cell concept using a light-emitting diode (LED) light source. Failure of the LED shall not cause an alarm condition but shall operate the detector trouble indicating lamp.

2.5.3 Detector Spacing and Location

****

NOTE: Do not show detector locations on plans, however a detail for mounting smoke detectors to the raised flooring system in compliance with this

paragraph should be shown.
****

In accordance with the requirements of NFPA 72, the manufacturer's recommendations and the requirements stated herein. Spacing and location of detectors shall take into account the airflow into the room and supply diffusers. Detectors shall not be placed closer than 1 1/2 meters 5 feet from any discharge grille. Spacing of detectors on room ceilings shall not exceed 41.80 square meter 450 square feet per detector. Spacing of detectors under raised floors shall not exceed 23.25 square meter 250 square feet per detector. Detectors installed beneath raised floors shall be mounted with the detector base within 50 mm 2 inches of the underside of the raised floor framing, with the detector facing downward. Where the space under the raised floor is less than 305 mm 12 inches in height, detectors shall be mounted with their bases either horizontal or vertical, with the detection chambers mounted in the upper half of the underfloor space. Under no circumstances shall detectors be mounted facing upward.

[2.6 DUCT SMOKE DETECTORS

****
NOTE: Automatic dampers are required in all ducts passing through walls, floors, and ceilings, to prevent the leakage of Halon from the protected space, and to prevent the communication of fire and smoke. Locations of dampers should be shown on HVAC plans. Additional smoke dampers may be required in systems over 424,740 L/m 15,000 cfm by NFPA 90A, Air Conditioning and Ventilating Systems. Coordinate with Section 23 09 53.00 20, SPACE TEMPERATURE CONTROL SYSTEMS. Provide access door in duct at each damper location. Connect duct detectors to Halon system control panel only if no building fire alarm system is provided. Otherwise delete paragraph entitled "Duct Smoke Detectors."
****

In accordance with the requirements of NFPA 90A, the manufacturer's recommendations and the requirements stated herein. Detectors required in ducts shall be ionization type and listed by UL Fire Prot Dir or FM APP GUIDEfor duct installation. Provide duct detectors with an approved duct housing, mounted exterior to the duct, with perforated sampling tubes extending across the width of the duct. Activation of duct detectors shall cause shut down of the associated air-handling unit, annunciation at the control panel, tripping of the [master box] [transmitter], and sounding of building fire evacuation alarms. Detector shall have a test port or switch.

][2.7 INHIBIT SWITCH

****
NOTE: Inhibit switches are optional devices which decrease system reliability and shall not be used without approval of the Division Fire Protection Engineer.
****

Provide one switch where shown. Activation of switch shall delay only equipment shutdown and agent discharge. Switch shall be guarded,

spring-loaded type which operates only when pressure is manually applied to the switch. Upon release of manual pressure, switch shall de-activate allowing delayed functions to resume. After start of agent discharge, switch shall have no effect. Activation of switch during normal (non-alarm) conditions shall cause activation of system trouble signals.

]2.8 ALARM SIGNALING DEVICES

Provide each protected area with audible and visual alarms located where shown. All alarm circuits shall be electrically supervised. Provide separate and distinct audible and visual pre-discharge and discharge signals. Where the building is equipped with a separate fire evacuation alarm system the discharge signals shall also be distinct from those used by the building fire evacuation system. Each signal device shall be provided with a rigid plastic or metal identification sign with lettering a minimum of 40 mm 1.5 inches high. The pre-discharge alarm shall be labeled "FIRE" and the discharge alarm shall be labeled "HALON DISCHARGE." [Post-discharge visual alarms shall be located outside all entrances to the protected areas, and shall be provided with signs reading "HALON DISCHARGED WHEN FLASHING - DO NOT ENTER].

2.8.1 Audible Alarms

a. Alarm bells

250 mm 10 inch [surface mounted] [recessed] with matching mounting back box. Bells shall be of the vibrating type suitable for use in an electrically supervised circuit. Bells shall be of the underdome type and produce a sound output rating of at least 90 decibels at 3 meters 10 feet.

b. Alarm horns

[Recessed,][Surface mounted,]vibrating type suitable for use in an electrically supervised circuit and shall have a sound output rating of at least 90 decibels at 3 meters 10 feet.

2.8.2 Visual Alarms

[Flush][Surface mounted]lamp assembly suitable for use in an electrically supervised circuit. Lamp shall be the flashing [stroboscopic] [incandescent] [rotary beacon] type and powered from the control panel alarm circuit. Lamps shall provide a minimum of 50 candle power. Flash rate shall be between 60 and 120 flashes per minute. Lamps shall be protected by a thermo-plastic lens, red for pre-discharge alarms and blue for discharge[and post-discharge] alarms.[Visual alarms may be part of an audio-visual alarm assembly.]

2.9 MAIN ANNUNCIATOR

Annunciator shall be integral with the main control panel. Provide separate alarm and trouble lamps for each zone alarm initiating circuit located on the exterior of the cabinet door or visible through the cabinet door. Supervision will not be required provided a fault in the annunciator circuits results only in loss of annunciation and will not affect the normal functional operation of the remainder of the system. Each lamp shall provide specific identification of the [zone] [area] [device] by means of a permanent label. In no case shall zone identification consist of the words "Zone 1," "Zone 2," etc., but shall

consist of the description of the [zone] [area] [device].

2.9.1 Annunciation Zones

Shall be arranged as follows:

2.9.2 Annunciator Panels

a. Remote annunicator panels

Locate as shown. Panel shall duplicate all requirements specified for the main control panel annunciator, except that in lieu of individual zone trouble lamps a single common system trouble lamp may be provided. Panel shall have a lamp test switch. Zone identification shall be by means of [permanently attached rigid plastic or metal plate(s).][Silk-screened labels attached to the reverse face of backlighted viewing windows(s).] Panel shall be of the [interior][weatherproof]type, [flush][surface] [pedestal]-mounted.

b. Graphic Annunciator Panel

Locate as shown. Panel shall be of the [interior][weatherproof]type, [flush][surface][pedestal]-mounted. Panel shall be provided with the [building][room] floor plan, drawn to scale, with remote alarm lamps mounted to represent the location of[each concealed detector][each alarm in initiating device].[Principal rooms and areas shown shall be labeled with their room numbers or titles.] The panel location shall be shown on the floor plan. Detectors mounted above ceilings, [on ceilings,] and beneath raised floors[and different types of initiating devices] shall have different symbols or lamps of different colors for identification. Lamps shall illuminate upon actuation of their corresponding device and shall remain illuminated until the system is reset. Panel shall have a lamp test switch.

2.10 AUTOMATIC FIRE DAMPERS

****

NOTE: Automatic dampers are required in all ducts passing through walls, floors, and ceilings, to prevent the leakage of Halon from the protected space, and to prevent the communication of fire and smoke. Locations of dampers should be shown on HVAC plans. Additional smoke dampers may be required in systems over 424,740 L/m 15,000 cfm by NFPA 90A, Air Conditioning and Ventilating Systems. Coordinate with Section 23 09 53.00 20 SPACE TEMPERATURE CONTROL SYSTEMS. Provide access door in duct at each damper location. Connect duct detectors to Halon system control panel only if no building fire alarm system is provided. Otherwise delete paragraph entitled "Duct Smoke Detectors."

****

Provide automatic control of fire dampers in air conditioning supply duct work as specified in Section 23 09 53.00 20 SPACE TEMPERATURE CONTROL SYSTEMS. Activation of fire dampers shall occur upon second zone detection, or upon activation of Halon discharge by manual pull station. Fire dampers are specified in Section 23 30 00 HVAC AIR DISTRIBUTION.

Provide heaters for fusible links.

[2.11 ELECTROMAGNETIC DOOR HOLDER RELEASE

Provide where shown. The armature portion shall be mounted on the door and shall have an adjusting screw for setting the angle of the contact plate. The electro-magnetic release shall be wall mounted, with a total horizontal projection not exceeding 100 mm 4 inches. All doors shall release to close upon first stage (pre-discharge) alarm. Electrical supervision of wiring external of control panel for magnetic door holding circuits is not required.

]2.12 ELECTRICAL WORK

[Electrical work is specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, except for control and fire alarm wiring.

]2.12.1 Wiring

Control and fire alarm wiring, including connections to fire alarm systems, shall be provided under this section and shall conform to NFPA 70. Wiring for 120 volt circuits shall be No. 12 AWG minimum. Wiring for low voltage DC circuits shall be No. [14] [16] AWG minimum. All wiring shall be color coded. Use rigid metal conduit or intermediate metal conduit, except electrical metallic tubing may be used in dry locations not enclosed in concrete and where not subject to mechanical damage.

2.12.2 Operating Power

Power shall be 120 volts AC service, transformed through a two winding isolation type transformer and rectified to 24 volts DC for operation of all signal initiating, signal sounding, trouble signal and [master box] [transmitter] tripping circuits. Provide secondary DC power supply for operation of system in the event of failure of the AC supply. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm. Obtain AC operating power to control panel and battery charger from the line side of the incoming building power source ahead of all building services. Provide independent properly fused safety switch, with provisions for locking the cover and operating handle in the "POWER ON" position for these connections and locate adjacent to the main distribution panel. Paint switch box red and suitably identify by a lettered designation.

2.12.3 Conductor Identification

All circuit conductors shall be identified within each enclosure where a tap, splice or termination is made. Conductor identification shall be by plastic coated self sticking printed markers or by heat-shrink type sleeves. Attach the markers in a manner that will not permit accidental detachment. Properly identify control circuit terminations.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Cut screw-jointed pipe accurately and work into place without springing or forcing. Ream pipe ends and free pipe and fittings from burrs. Clean with solvent to remove all varnish and cutting oil prior to assembly.

Make screw joints with tetrafluoroethylene tape applied to male thread only.

3.2 FIELD PAINTING

****
NOTE: Coordinate Section 09 90 00, PAINTS AND COATINGS with this paragraph.
****

Clean, pretreat, prime, and finish paint new Halon 1301 fire extinguishing systems, including piping, conduit, hangers and miscellaneous metalwork. Apply coatings only to clean, dry, surfaces using clean brushes. Clean surfaces to remove all dust, dirt, rust and loose mill scale. Immediately after cleaning, the metal surfaces shall receive one coat of primer conforming to FS TT-P-645 applied to a minimum dry film thickness of 0.025 mm one mil. Exercise due care to avoid the painting of operating devices. Materials which are used to protect devices, while painting is in process, shall be removed upon the completion of painting. Remove all devices which are painted and provide new clean devices of the proper type in lieu thereof.

3.2.1 Systems in Unfinished Areas

Unfinished areas are defined as attic spaces, spaces above suspended ceilings, spaces under raised floors, crawl spaces, pipe chases, and spaces where walls or ceiling are not painted or not constructed of a prefinished material. Primed surfaces shall receive one coat of red enamel conforming to CID A-A-2962 applied to a minimum dry film thickness of 0.025 mm one mil and color coded in accordance with MIL-STD-101.

3.2.2 Systems in All Other Areas

Primed surfaces shall receive two coats of paint to match adjacent surfaces, except stop valves and accessories shall receive one coat of red enamel conforming to CID A-A-2962 applied to a minimum dry film thickness of 0.025 mm one mil. Provide piping with 50 mm 2 inch wide red bands spaced at maximum of 6 meters 20 feet intervals throughout the piping systems, except in finished areas such as offices, the red bands may be deleted. Red bands shall be red enamel or self adhering red plastic tape and color coded in accordance with MIL-STD-101.

3.3 FIELD TESTING

Perform tests in the presence of the Contracting Officer to determine conformance with the specified requirements.

3.3.1 Preliminary Tests

Each piping system shall be pneumatically tested at 1034 kPa (gage) 150 psig and shall show no leakage or reduction in gage pressure after 30 minutes. The contractor shall conduct complete preliminary tests, which shall encompass all aspects of system operation. Individually test all detectors, manual actuation stations, alarms, control panels, and all other components and accessories to demonstrate proper functioning.

3.3.2 Formal Inspection and Tests

The [_____] Division, Naval Facilities Engineering Systems Command, Fire

Protection Engineer, will witness formal tests and approve all systems before they are accepted. The system shall be considered ready for such testing only after all necessary preliminary tests have been made and all deficiencies found have been corrected to the satisfaction of the equipment manufacturer's technical representative and the Contracting Officer. Submit the request for formal inspection at least 15 days prior to the date the inspection is to take place. The control panel(s) and detection system(s) shall be in service for a "break-in" period of at least 15 consecutive days prior to the formal inspection. Experienced technicians regularly employed by the contractor in the installation of both the mechanical and electrical portions of such systems shall be present during the inspection and shall conduct the testing. All Halon 1301, instruments, personnel, appliances and equipment for testing shall be furnished by the contractor. All necessary tests encompassing all aspects of system operation shall be made including the following, and any deficiency found shall be corrected and the system retested at no cost to the Government.

3.3.2.1 System Function Tests Without Halon Discharge

The entire detection/alarm/actuation system shall be operated. As a minimum, operation and supervision of the following functions and devices shall be demonstrated.

a. All operational and supervisory functions of the control and annunciator panels, including the cross-zoning, pre-discharge alarm, discharge alarm[, post-discharge alarm] and time delay features.

b. Each manual actuation station and associated circuit(s).

c. All smoke detectors and associated circuits.

d. All pre-discharge[,][and] discharge[and post-discharge] alarms and associated circuits.

e. All actuator circuits and discharge heads (without Halon discharge).

f. Air handing[and computer] equipment shutdown.

g. Automatic fire dampers.

h. Activation of the building fire evacuation alarm system.

i. Activation of the Base fire alarm system (receipt of fire alarm at alarm office).

j. All of the above tests shall be repeated with the system on battery power only.

3.3.2.2 Halon Discharge Tests

When all of the detection/alarm/actuation, and supervisory functions of the system operate to the satisfaction of manufacturer's technical representative, the Division Fire Protection Engineer, and the Contracting Officer, a complete discharge test of Halon system shall be performed to demonstrate satisfactory performance, Halon concentration, uniformity of Halon concentration, system discharge time, mechanical operation and operation of valves, release devices, alarms, and interlocks which control

the protected area. Halon 1301 shall be used for this test; substitution of agents is not permitted. This test shall be conducted by experienced personnel according to the equipment and Halon manufacturer's recommendations. All personal required to be in the protected area during or immediately after the test shall wear self-contained, positive pressure breathing apparatus. Contractor shall provide all breathing apparatus, except apparatus for Government personnel shall be provided by the Government. Halon concentration shall be monitored at a minimum of 3 sampling points in each protected area. Provide a calibrated strip chart recorder for continuous recording of concentrations at each monitoring point. Table I at end of this section shall be completed using observations taken during this test.

3.4 OPERATING INSTRUCTIONS

Provide operating instructions at each remote control station. Instructions shall clearly indicate all necessary steps for the operation of the system. Instructions shall be in raised or embossed white letters on red rigid plastic or red enameled steel backgrounds and shall be of adequate size to permit them to be easily read.

3.5 TRAINING REQUIREMENTS

Prior to final acceptance, the Contractor shall provide operation and maintenance training to the Base Fire Department and [Public Works] [Civil Engineering] [and] [Computer] personnel. Each training session shall include [computer] emergency procedures, and unique maintenance and safety requirements. Training areas will be provided by the Government in the same building as the protected areas. The training conducted shall use operation and maintenance manuals called for in paragraph entitled "Operation and Maintenance Instructions, Parts and Testing." Dates and times of the training period shall be coordinated through the Contracting Officer not less then two weeks prior to the session. Government shall be provided with a simplified training manual providing a description of operation and controls, possible hazards to personnel, and restart procedures for[computers and] air handling units.

TABLE I

HALON 1301 DATA (EACH ROOM & UNDER FLOOR)

Date:_____

Room Description
_____

Dimensions (m) Length _____ Height _____ Width _____
Area _____ Sq Meters Volume _____
Ventilation Rate into Room _____ Cubic Meter per Second
Specific Volume At Design Temp. _____
Design Temp. _____ Deg C Max. Temp Expected _____ Deg C
Percent Design Concentration _____ kg 1301 Required _____
Number of Nozzles _____ Sq Meter/Nozzle_____
Kg 1301 to be Supplied/Nozzle _____(Based on no air flow)
Discharge Time _____
Concentration at Design Temperature _____ percent
Concentration at Max Temperature _____ percent

Concentration	Point A	Point B	Point C
0 Seconds after end of Discharge percent C	_____	_____	_____
5 Seconds after end of Discharge percent C	_____	_____	_____
10 Seconds after end of Discharge percent C	_____	_____	_____
15 Seconds after end of Discharge percent C	_____	_____	_____
20 Seconds after end of Discharge percent C	_____	_____	_____
25 Seconds after end of Discharge percent C	_____	_____	_____
30 Seconds after end of Discharge percent C	_____	_____	_____
40 Seconds after end of Discharge percent C	_____	_____	_____
50 Seconds after end of Discharge percent C	_____	_____	_____
60 Seconds after end of Discharge percent C	_____	_____	_____
120 Seconds after end of Discharge percent C	_____	_____	_____

Agent Tanks to be Supplied for test use _____kg Each
Free Venting Requirements _____ kg/sq meter allowable strength
this requires _____ sq mm free venting area

TABLE I

HALON 1301 DATA (EACH ROOM & UNDER FLOOR)

Date:_____

Room Description
_____

Dimensions (Ft) Length _____ Height _____ Width _____
Area _____ Sq Ft Volume _____
Ventilation Rate into Room _____ Cubic Feet per Minute
Specific Volume At Design Temp. _____
Design Temp. _____ Deg F Max. Temp Expected _____ Deg F
Percent Design Concentration _____ lbs 1301 Required _____
Number of Nozzles _____ Sq Ft/Nozzle _____
Lbs 1301 to be Supplied/Nozzle _____(Based on no air flow)
Discharge Time _____
Concentration at Design Temperature _____ percent
Concentration at Max Temperature _____ percent

Concentration	Point A	Point B	Point C
0 Seconds after end of Discharge percent C	_____	_____	_____

TABLE I

HALON 1301 DATA (EACH ROOM & UNDER FLOOR)

5 Seconds after end of Discharge percent C	_____	_____	_____
10 Seconds after end of Discharge percent C	_____	_____	_____
15 Seconds after end of Discharge percent C	_____	_____	_____
20 Seconds after end of Discharge percent C	_____	_____	_____
25 Seconds after end of Discharge percent C	_____	_____	_____
30 Seconds after end of Discharge percent C	_____	_____	_____
40 Seconds after end of Discharge percent C	_____	_____	_____
50 Seconds after end of Discharge percent C	_____	_____	_____
60 Seconds after end of Discharge percent C	_____	_____	_____
120 Seconds after end of Discharge percent C	_____	_____	_____

Agent Tanks to be Supplied for test use _____Lb Each

Free Venting Requirements _____ lbs/SF allowable strength

this requires _____ sq. in. free venting area

-- End of Section --