UNIFIED FACILITIES CRITERIA (UFC)

FINAL DRAFT

FIRE PROTECTION ENGINEERING

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UNIFIED FACILITIES CRITERIA (UFC)

FINAL DRAFT FIRE PROTECTION ENGINEERING

U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	Date	Location
1	11/29/2007	Chap 2-2, various locations
2	11/29/2007	Chap 2-4, relocated MNS requirements.
3	11/29/2007	Chap 2-4.6.7, updated shunt-trip requirements.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DOD Field Activities in accordance with USD (AT&L) Memorandum dated 29 May 2002. UFC will be used for all DOD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request (CCR). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site http://dod.wbdg.org/.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

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UNIFIED FACILITIES CRITERIA (UFC)
NEW DOCUMENT SUMMARY SHEET

Document: UFC 3-600-10N, *Fire Protection Engineering*
Superseding: None

Description: This UFC 3-600-10N provides fire protection system engineering design and analysis criteria for design-build and design-bid-build projects.

Reasons for Document:

- Provide minimum technical requirements for fire protection system design criteria.
- Provide supplemental requirements to UFC 3-600-01, *Fire Protection Engineering for Facilities.*
- Provide direction for fire protection engineers in the development of the plans, specifications, calculations, and Design/Build Request for Proposals (RFP).

Impact: There are negligible cost impacts. However, the following benefits should be realized.

- Standardized guidance has been prepared to assist fire protection engineers in the development of the plans, specifications, calculations, and Design/Build Request for Proposals (RFP).

This guidance has been prepared along with updates to the associated Performance Technical Specifications and Engineering Systems Requirements documents. The three types of documents have been aligned to allow improved consistency in the preparation of project requirements.

CONTENTS

CHAPTER 1 INTRODUCTION

1-1 PURPOSE AND SCOPE.

The purpose of this UFC is to provide technical guidance and outline technical requirements for the more typical aspects of the fire protection engineering pertaining to the design and construction of facilities for the Naval Facilities Engineering Command (NAVFAC). The information provided in this UFC must be used by fire protection engineers in the development of the plans, specifications, calculations, and Design/Build Request for Proposals (RFP) and serve as the minimum fire protection engineering design requirements. This UFC provides supplemental requirements to UFC 3-600-01, *Fire Protection Engineering for Facilities.* Information and requirements pertaining to performance verification and acceptance testing are also identified. Project specific conditions may dictate the need for design services and/or features that exceeds these minimum requirements.

1-2 APPLICABILITY.

This UFC applies to all Naval Facilities Engineering Command components and their contractors that are preparing construction contract documents and specifications for all projects on naval installations. It is applicable to the traditional design services customary for Design-Bid-Build construction contracts and for Design-Build construction contracts.

1-3 REFERENCES.

Appendix A contains the list of references used in this document. Furthermore, this document references UFC 1-200-01, *General Building Requirements*, as applicable.

1-4 COMMUNICATIONS.

Direct communication with the government's project manager and fire protection engineering reviewer is encouraged. This may avoid unnecessary re-submittal of plans and specifications due to a misunderstood comment. Communications must be subject to contractual protocol.

1-5 AUTHORITY.

The term "Authority Having Jurisdiction (AHJ)" as used in the codes and standards is defined in Unified Facilities Criteria 3-600-01, *Fire Protection Engineering for Facilities*, as the Chief Fire Protection Engineer at Naval Facilities Engineering Command, Headquarters. For the administration of contracts, the AHJ is delegated to the cognizant Naval Facilities Engineering Command, Fire Protection Engineer (NAVFAC, FPE).

CHAPTER 2 SYSTEM REQUIREMENTS

2-1 INTRODUCTION.

This section identifies the requirements and expectations for different aspects of the fire protection and system safety design process. Frequent reference is made to various design documents, criteria and other sources of information throughout this document. Hyperlinks to the Internet home pages of these sources have been provided for the user's convenience and are located within this document.

2-2 WATER SUPPLY AND DISTRIBUTION SYSTEMS.

Ensure the water supply can meet 150% of the fire pump's rated capacity with a minimum pressure of 20 psi (137.9 kPa) at the suction side of the pump.**\1** Notify the cognizant AHJ if the existing water supply can not meet this requirement.**/1/**

2-2.1 Storage.

2-2.1.1 Bolted steel water storage tanks are prohibited.

2-2.1.2 Provide cathodic protection.

2-2.1.3 Discharge lines from flow meters, pressure-relief valves and fill lines must return to the tank above the maximum fill line, i.e. provide an air gap.

2-2.2 Distribution Systems.

2-2.2.1 Minimum size for main piping supplying fire sprinkler systems must be 6 inches (152 mm) in diameter.

2-2.2.2 See UFC 3-200-10N, *Civil Engineering,* for velocity limits in water supply piping. Base velocities for mains serving fire pumps (supply and discharge sides) on pumps operating at 150 percent of rated capacity.

2-2.2.3 **\1**For Navy projects, secure**/1/** all post indicator valves (PIVs) with a lock. Do not supervise PIVs with tamper switches.

2-2.3 Fire Pumps & Foam Concentrate Pumps.

2-2.3.1 **Location.** **\1**Located pumps in a fire-rated room or detached structure with double-door or overhead door for maintenance access directly to the exterior.**/1/**

2-2.3.2 **Clearance.** Provide at least 4 feet (1220 mm) of clearance around the pump, pump controller, and control valves in the pump piping.

2-2.3.3 **Drivers.** For diesel engine driven pumps, provide separate electric circuits for both the pump controller and the engine block heater.

2-2.3.4 **Controllers.** For electric driven pumps provide solid state soft start, reduced voltage controllers.

2-2.3.5 **Field Painting.** Clean, pretreat, and prime all piping. Paint all piping with one coat of red alkyd gloss enamel. After all field painting is complete, provide labeling on the surfaces of the piping in the pump room to show the water flow direction and pipe function (i.e., "Intake", "Discharge", "To Fire Dept. Connection", "To Bypass", "To Test Header", "To Standpipe", "To Sprinkler System", etc.). Provide white painted stenciled letters and arrows, a minimum of 2 inch (50 mm) in height and visible from at least 3 sides.

2-2.3.6 **Water Fire and Booster Pumps.**

2-2.3.6.1 **Capacity. \1**Size pumps **/1/**so the maximum sprinkler demand or interior standpipe demand does not exceed 140% of rated pump capacity.

2-2.3.6.2 **Type.** Do not use vertically orientated split case pumps, unless the cognizant AHJ provides approval.

2-2.3.6.3 **Test Header.** Provide a linear test header manifold on the building exterior that permits flow testing directly from header with minimal use of hose. Coordinate the location of flow testing facilities with other disciplines to ensure flow from test header does not discharge onto other equipment.

2-2.3.6.4 **Flow Meter.** Provide a flow meter in addition to a test header. Locate the flow meter such that both the test loop and the test header arrangement are metered.

2-2.3.7 **Aqueous Film-Forming Foam (AFFF) Concentrate Pumps.** Provide foam concentrate jockey pumps where foam concentrate lines to the injection points exceed 50 feet.

2-2.4 **Cross-Connection Protection.**

2-2.4.1 Locate backflow preventers in the building or within a heated enclosure if freeze protection is necessary. Heat trace must not be used. Provide a low temperature supervisory alarm connected to the building FACP for heated enclosures.

2-2.4.2 Locate backflow preventer assemblies no greater than 36-inches, (915 mm) measured from the bottom of the assembly, above finished floor.

2-2.5 **Drains.**

Terminate all drainage piping or test piping from the fire pump or associated appurtenances (i.e., circulation relief valve, bowl drains, etc.), including backflow preventers, to the exterior of the building so it will not cause damage. Discharge to the exterior must not interfere with exiting from the building. Water discharge must not cross an exit or exit discharge. Drainage piping of less than ¾ -inch (20 mm) may discharge to a floor drain.

2-3 FIRE SUPPRESSION SYSTEMS.

2-3.1 Water Based.

2-3.1.1 Design.

2-3.1.1.1 Hydraulic calculations must include a minimum pressure drop across backflow preventers of 12 psi (82.7 kPa), or the actual pressure drop, which ever is greater, regardless of type or size.

2-3.1.1.2 Locate the fire department connections as directed by the cognizant AHJ in conjunction with the Chief Fire Inspector for the base.

2-3.1.1.3 Provide two remotely located interconnected fire department connections when the building footprint exceeds 50,000 ft^2 (4,645 m^2).

2-3.1.1.4 For cold storage facilities follow the requirements of Factory Mutual data sheet 8-29 Refrigerated Storage explicitly, as well as other requirements of this document.

2-3.1.2 Wet Pipe Systems.

2-3.1.2.1 Where multiple computer or electronic equipment rooms are located in one area, coordinate with the cognizant AHJ and the customer on the shutdown requirements. If all adjacent areas may be considered as one, with power to all discontinued simultaneously, the entire area may be protected by one sprinkler system and sub-floor extinguishing system. However, if the customer requires each physically separated area to operate independently of the other, provide separate shutdown capabilities. This will necessitate dedicated systems for under-floor protection and dedicated feed mains and associated flow switches for each area.

2-3.1.2.2 When Sprinkler systems are provided in family housing in climates subject to freezing, sprinkler piping is prohibited from being run in attic spaces. Run upper story piping only in interior walls with sidewall sprinklers. Any other configuration must be approved by the AHJ.

2-3.1.3 Dry Pipe Systems.

2-3.1.3.1 Each dry pipe system must not exceed a volume of 750 gallons (2,839 L) regardless of the delivery time or devices attached.

2-3.1.3.2 Deliver the water to the system test connection in not more than 60 seconds, starting at the normal air pressure on the system.

2-3.1.3.3 Provide Schedule 40, galvanized piping.

2-3.1.3.4 Shop air and compressed gas cylinders are not acceptable sources of air for system pressurization.

2-3.1.4 **Preaction/Deluge Systems.**

2-3.1.4.1 See Section 2-4.3 for requirements pertaining to detection/control/release systems.

2-3.1.4.2 Provide Schedule 40, galvanized piping.

2-3.1.4.3 In cold Storage facilities utilize a double interlocked preaction systems in areas maintained below 40^{o}F and activate the system with a line type thermal detection system. Pre-action sprinkler system compressed air must be taken from the coldest storage compartment and dehydrated after the last pressure regulator by an oversized chemical desiccant dryer. Do not use twin tower self-regenerating dryers.

2-3.1.5 **Foam Systems.**

2-3.1.5.1 See Section 2-4.3 for requirements pertaining to detection/control/release systems.

2-3.1.5.2 Do not provide vertical bladder tanks. Locate tanks with sufficient space to allow the bladder to be replaced with the tank in place. For existing facilities, vertical bladder tanks may be used subject to approval by the AHJ.

2-3.1.5.3 Provide permanent means to flow test proportioner(s) through linear test headers.

2-3.1.5.4 On wet systems, provide means to conveniently test and drain the system into 55-gallon drums (i.e., drain connections terminating 5 feet above finished floor with hose connections, with access for hand carts or fork lift trucks to remove the filled drums).

2-3.1.5.5 For automatic control of foam concentrate, provide deluge valves listed/approved for use with foam concentrate.

2-3.1.5.6 Isolation control valves shall be full port ball type with operating handle that indicates the on/off position of the valve. Unit shall be socket weld or flanged type. Valve body and ball shall be of 316 stainless steel complying with ASTM A351.

2-3.1.5.7 Provide spill control around foam tanks to prevent spilled foam concentrate from reaching any drains. Spill control shall be sized to contain the tank capacity.

2-3.1.5.8 Provide stainless steel foam concentrate piping with rolled grooved fittings, welded joints and fittings, or flanged joints and fittings. If using welded joints and fittings, provide flanged joints to allow for equipment removal and maintenance.

2-3.1.5.9 Foam concentrate lines must not be located underground.

2-3.1.5.10 Provide the following where fuel tanks require foam fire suppression systems:

a. A connection for a pressure gauge in each foam chamber riser downstream of the orifice plate.

b. When utilizing the fire department to supply water or foam solution, provide an engraved sign at the fire department connection stating minimum system operating pressure and flow.

2-3.1.6 **Piping.**

2-3.1.6.1 See Sections 2-3.1.2 – 2-3.1.5 for additional requirements pertaining to specific system types.

2-3.1.6.2 Provide all equipment, i.e., control valves, backflow preventer, check valves, floor control valve assemblies with a minimum clearance of 3 feet (915 mm).

2-3.1.6.3 For other than residential occupancies, sprinkler pipe and fittings must be metal. For residential occupancies, CPVC may be used where piping is concealed by gypsum or plaster construction, and installed in accordance with product listing.

2-3.1.6.4 Provide Schedule 40 steel piping for sizes less than 2-inches (50 mm) in diameter. Provide no less than Schedule 10 steel piping for sizes 2-inches (50 mm) and larger.

2-3.1.6.5 Plain end fittings with mechanical couplings and fittings that use steel gripping devices to bit into the pipe are prohibited. Steel piping with wall thickness less than Schedule 40 must not be threaded.

2-3.1.6.6 All rubber gasket grooved-end pipe fittings for dry pipe systems must be listed/approved for dry pipe systems.

2-3.1.6.7 Do not provide side outlet tees using rubber gasket fittings in new construction. For renovation projects side outlet tees are only permissible where connecting to existing piping.

2-3.1.6.8 The same manufacturer must supply fittings, mechanical couplings, and rubber gaskets.

2-3.1.6.9 All sprinkler piping must be concealed except in spaces without ceilings.

2-3.1.6.10 Provide fittings for changes in direction of piping and for connections. Make changes in pipe sizes through tapered reducing pipe fittings

2-3.1.6.11 Where piping is galvanized, roll-grooved fittings are not permitted.

2-3.1.6.12 Thrust rod and sleeve all pipe penetrations of grade floor slab.

2-3.1.7 **Painting.**

Clean, pretreat, and prime all piping. Paint all sprinkler piping with one coat of red alkyd gloss enamel. Piping in finished areas that do not have sprinklers directly connected

them may be painted to match adjacent surfaces, provided piping is identified by painting 2-inch (50 mm) wide red alkyd gloss enamel bands every 10 feet (3.0 m) and on both sides of wall, ceiling, or floor penetrations. Subject to approval by the Contracting Officer, painting all pipe fittings in finished areas with red alkyd gloss enamel may be considered an acceptable alternative to painting bands.

2-3.1.8 **Drains.**

2-3.1.8.1 Provide concrete splash blocks at main drain and inspector test connection discharge locations if not discharging to a paved surface

2-3.1.8.2 Terminate all drainage and inspector test connection piping to the exterior of the building so it will not cause damage. Discharge to the exterior must not interfere with exiting from the building. Water discharge must not cross an exit or exit discharge.

2-3.1.8.3 Any drains, test connection pipe, etc that penetrate the exterior wall must do so not greater than 2 feet (610 mm) above finished grade.

2-3.1.8.4 The drain/test connection must be piped to a location that will accept full flow and will not cause property damage when water is discharging. Discharge to any sink is not acceptable.

2-3.1.8.5 To facilitate testing, provide a permanently piped drain/test connection for each flow switch.

2-3.1.9 **Valves.**

2-3.1.9.1 Provide floor control assemblies at each respective floor.

2-3.1.9.2 The floor control valve assembly must consist of a control valve, check valve, water flow switch, drain/test connection, gauges, and must be electrically supervised.

2-3.1.9.3 Provide a separately zoned control valve assembly for piping serving Elevator Machine Rooms, Computer Rooms, Laboratories, and similar rooms that require shunt-tripping of equipment simultaneously to the application of water. Locate the zoned control valve assembly outside of the area it serves in an easily accessible identified location.

2-3.1.9.4 Provide valve tamper switches (with tamper proof covers) for all normally open sprinkler system control valves, including isolation valves on backflow preventers, unless otherwise directed by the AHJ.

2-3.1.10 **Sprinklers.**

2-3.1.10.1 Provide quick-response concealed sprinklers in all spaces with finished ceilings that contain electrical, electronic, and other water sensitive equipment.

2-3.1.10.2 Extended coverage sprinklers are not permitted, unless approved by the AHJ.

2-3.1.10.3 Provide sprinkler guards for sprinklers that are less than 7 feet (2.1 m) above finished floor.

2-3.1.10.4 Where provided, sprinklers installed in any detention cell, regardless of the building occupancy classification, must be listed/approved institutional style sprinklers.

2-3.2 **Gaseous Suppression Agents.**

2-3.2.1 For CO_2 systems provide a purge system to evacuate the CO_2 after testing or discharge.

2-3.2.2 Provide separate storage bottles/manifold for each hazard. Do not design multiple hazard protection using a selector valve and a common manifold

2-3.2.3 Provide the storage bottle manifold with scales for weighing the cylinders

2-3.2.4 The use of halon, or any other ozone depleting substances, is strictly prohibited.

2-3.2.5 For projects involving the demolition of existing Halon 1301, refer to https://www.denix.osd.mil/denix/Public/News/DLA/ODS/tpreface.html for turn in requirements.

2-4 **FIRE ALARM, DETECTION, MASS NOTIFICATION, AND CONTROL SYSTEMS.**

2-4.1 **Control Panels.**

2-4.1.1 Provide analog/addressable, site programmable fire alarm systems unless otherwise directed by the AHJ.

2-4.1.2 At a minimum, provide the fire alarm control panel (FACP) with the following features:

a. The ability to store at least 400 events in the history log. These events must be stored in a non-volatile memory and remain in the memory until the memory is downloaded or cleared manually.

b. Resetting of the control panel must not clear the memory from being retrieved on the integral LCD display.

c. An integral LCD 80 character (minimum) alphanumeric display.

d. An RS 232-C port.

e. Provide all smoke detectors connected to the FACP with an adjustable alarm verification feature. Initially set the alarm verification at 20 seconds.

2-4.1.3 In new construction, FACP cabinets located in public spaces must be recessed and not be aesthetically obtrusive.

2-4.1.4 Locate the FACP and supplemental control panels in a year-round conditioned space within the building.

2-4.1.5 Locate Notification Appliance Circuit (NAC) extender panels in electrical rooms and/or telecommunication rooms on each floor. Locate panels less than 5 feet (1525 mm) above the finished floor, measured to the centerline of the panel. Each extender panel must be individually addressed.

2-4.1.6 Provide a remote annunciator at the designated primary entrance unless directed otherwise by the contract bid documents. Provide remote annunciator(s) with control functions similar to the main fire alarm control panel. Control functions must be accessible only by user code or secured behind a locked panel.

2-4.1.7 Provide panel in the manufacturer's NEMA 4 enclosure for panels subject to water spray/runoff under normal operating conditions and/or located in damp/dirty locations or, relocate to a suitable dry location at the direction of the Contracting Officer. Conduit must not enter the top of a control panel cabinet for enclosures requiring a NEMA 4 designation.

2-4.2 **Power Supply.**

2-4.2.1 Coordinate the primary power for the fire alarm systems with the electrical engineer. See UFC 3-500-10N, *Electrical Engineering,* for requirements.

2-4.2.2 Provide rechargeable lead calcium or sealed lead acid type batteries to operate the fire alarm system under supervisory conditions for 48 hours and audible and all alarm devices for an additional 10 minutes. Where the fire alarm system also serves as a Mass Notification System refer to UFC 4-021-01, *Design and O&M: Mass Notification Systems*, for additional requirements.

\22-4.3 **Panels Used for Mass Notification.**

2-4.3.1 For Naval installations requiring a Mass Notification System, this may be incorporated as a function of the building fire alarm system utilizing a voice evacuation system.

2-4.3.2 The default voice evacuation message must be a female voice and a state the following:

"May I have your attention please? May I have your attention please? A fire emergency has been reported in the building. Please leave the building by the nearest exit or exit stairway. Do not use the elevators." <Provide a 2 second pause> "May I have your attention please..."(repeat the message).***/2/***

2-4.4 **Panels Used for Fire Suppression Control & Release.**

2-4.4.1 In addition to the requirements specified above, panels used for control/release of fire suppression systems must be listed for releasing service and incorporate the following features.

2-4.4.2 Provide a separate releasing panel independent of the building fire alarm system panel to activate the system.

Exception: If the initiating devices comprise 75% or more of the entire facility alarm initiating devices, a combined preaction releasing/building fire alarm system panel may be used if approved by the cognizant AHJ.

2-4.4.3 A common releasing panel may control multiple systems or agents.

2-4.4.4 Electronic solenoids used for release of the suppression system must be listed/approved for use with both the releasing panel and the suppression equipment.

2-4.4.5 Provide rechargeable lead calcium or sealed lead acid type batteries to operate the fire alarm system under supervisory conditions for 48 hours and alarm conditions for an additional 15 minutes. Include the full current draw of the solenoid in the battery calculations.

2-4.4.6 When more than one panel is used, each panel must be monitored independently by the building fire alarm control panel.

2-4.4.7 Locate the panel adjacent to the hazard/area served.

2-4.4.8 Provide interlocks to shut down all computer equipment power and associated room air conditioner power prior to agent discharge.

2-4.4.9 When required, pre-discharge and discharge alarms must consist of audible and visual notification appliances that are different than the building fire alarm system notification appliances.

2-4.5 **Renovation to Existing Systems.**

2-4.5.1 Unless the AHJ directs otherwise, replace existing non-addressable fire alarm panels with a new analog/addressable panel. Existing devices and circuits may remain. New devices and circuits must be addressable.

2-4.5.2 Ensure the power supply is capable of supporting the electrical load of the new devices and submit battery calculations.

2-4.5.3 Reuse of existing conduit runs is acceptable but must be undertaken at the risk of the installation contractor and must perform as if installed new.

2-4.5.4 If the existing system is to be completely replaced all conductors must be replaced with new.

2-4.5.5 If the work involves only partial renovation of a facility and a new FACP is required for the renovated areas, demolish the existing FACP. Existing circuits in the unrenovated areas of the building may be retained and connected to the new FACP.

2-4.6 **Initiating Devices.**

2-4.6.1 Provide a separate address for each flow switch.

2-4.6.2 Monitor high and low air pressure on dry pipe systems on a per riser basis as a supervisory function with the building fire alarm system.

2-4.6.3 Provide addressable double action type manual pull stations with mechanical reset features. Break-glass-front stations are prohibited. If the manual alarm station requires a key for reset, it must be the same key as required for the fire alarm control panel.

2-4.6.4 Locate manual pull stations at each door to the exterior and at each door into an exit stairwell.

2-4.6.5 When under-floor smoke detectors are provided, provide a graphic showing the location of the devices in the room. Locate a single graphic outside of the space the smoke detectors are in and adjacent to the main entrance to that space.

2-4.6.6 Provide remote test switches and remote light emitting diodes (LED's) for each duct smoke detector.

2-4.6.7 **\3**For shunt-tripping of power supplies, provide listed control relays located within 1m (3 ft.) of the shunt trip breaker. Operation of relay shall be controlled by a listed fire alarm control unit. Relay shall function within the voltage and current limitations of the fire alarm control unit. Relay contacts shall be listed for the connected load.***/3/***

2-4.6.8 Provide 24 Vdc photoelectric analog/addressable smoke detectors in all barracks, dormitories, lodges, and temporary or transient living facilities sleeping rooms and entry/common area to bedrooms. Provide smoke detectors with sounder bases. Smoke detectors in sleeping rooms must cause the sounder base to activate for all smoke detectors in that suite and an alarm signal to activate at the FACP, but must not activate the building's evacuation alarm.

2-4.6.9 Multiple station 120 VAC smoke detectors provided for Family Housing projects must be powered by common circuits.

2-4.7 **Notification Appliances.**

2-4.7.1 Bathrooms serving private offices do not require visual appliances.

2-4.7.2 Provide a minimum of 1 notification appliance circuit per floor. Each notification appliance circuit loading must not exceed 80% of its rated output.

2-4.7.3 In addition to devices required by Code, provide audible notification appliances in each sleeping room regardless of occupancy classification. The provision of a room smoke detector sounder base does not negate the requirement of the audible notification appliances for each sleeping room.

2-4.8 **Wiring, Circuits and Conduit.**

2-4.8.1 All terminations must be at a terminal strip.

2-4.8.2 All devices must have screw terminals.

2-4.8.3 Pull all conductors splice free. Where splices are unavoidable provide insulated barrier type terminal strips at junction points. The use of wire nuts, crimped connectors, or twisting of conductors is prohibited.

2-4.8.4 Run all wiring to control panels in the vertical or horizontal plane, make all turns at 90 degree angles, and tightly bundle and wrap all wire.

2-4.8.5 Identify all conductors individually with permanent markings.

2-4.8.6 Install all wiring in metallic conduit.

2-4.8.7 All wiring must be solid copper, except for speaker circuits or circuits requiring shielding.

2-4.8.8 All signaling line and initiating device circuits must be minimum 16 gauge wire.

2-4.8.9 Initiating device circuits used for flame detection devices must use shielded cable.

2-4.8.10 Paint all fire alarm junction boxes and covers red in unfinished areas (i.e., above ceilings, mechanical rooms, etc). In finished areas, conduit and junction boxes can be painted to match the room finish, the inside cover of the junction box must be identified as “Fire Alarm” and the conduit must have painted red bands ¾ -inch (20 mm) wide at 10 foot (3.0 m) centers and at each side of a floor, wall, or ceiling penetration.

2-4.9 Connection to Basewide Reporting Systems.

2-4.9.1 Provide fire alarm reporting compatible with the existing base fire reporting system.

2-4.9.2 Where the base reporting system has the capability, alarm of sleeping room smoke detectors for barracks, dormitories, lodges, and temporary or transient living facilities must send a separate and distinct signal via the base fire reporting system.

2-5 PASSIVE FIRE PROTECTION SYSTEMS.

2-5.1 Air Handling Equipment.

2-5.1.1 Provide access doors in finished ceilings at all fire damper locations. Size the access door to allow physical access to the duct.

2-5.1.2 Protect duct through-penetrations of fire rated partitions having a fire resistive rating of less than 2 hours with fire stop systems listed/approved for the

particular opening size and duct assembly. If a listed/approved firestop system is not available for the particular assembly, protect the opening with a fire damper.

2-5.2 Fire Wall Identification.

Identify all fire rated walls with signs stating the following; "Fire Wall Do Not Penetrate". For aesthetic reasons, this requirement does not apply to walls inside stairwells or public areas such as offices, lobbies, corridors, etc that do not have drop ceilings. In areas with drop ceilings, paint notification on the wall above the drop/finished ceiling. In mechanical, electrical and other similar rooms, place signs at 8-feet (2.4 m) above finished floor level. Space signs at a maximum of 10-foot (3.0 m) intervals. In rooms with raised flooring, place signs on fire walls under the floor with spacing of signage reduced to 5 foot (1.5 m) intervals. Apply signs using florescent red or orange paint over stencils. Letters must be a minimum of 4-inches (100 mm) in height. Metal, plastic or paper decal signs are not acceptable. Take care when applying signage to prevent over-spray onto adjacent finishes.

2-5.3 Navy Marine Corps Intranet (NMCI) Coordination.

Refer to UFC 3-580-10, *Navy and Marine Corps Intranet (NMCI) Standard Construction Practices*, for additional fire protection features of designated NMCI spaces within a facility.

2-5.4 Spray Applied Fire Proofing.

Obtain the rating of the floor/ceiling and roof/ceiling assembly without the underside of the deck having spray-applied fireproofing. Only columns, beams, and trusses may receive spray-applied fireproofing.

CHAPTER 3 DESIGN SUBMITTAL REQUIREMENTS

3-1 INTRODUCTION.

This chapter identifies the expected level of detail and quality of submittals. While the extent of the detail provided in the submittal documents may depend on the stage of the design, the following information is critical to ensure the documents are complete and biddable. Additional information with respect to design criteria and preferences is identified in the following sections.

3-2 PRE-DESIGN FIELD INVESTIGATION.

Pre-design field investigations are an essential part of the design-bid-build and RFP preparation process. Many of the functions identified under this heading are also essential during the DD1391 validation process to assure the project has the appropriate funding based on the scope of work. Section 3-2 is not applicable for post-award services of design-build contracts unless specifically addressed in the RFP.

3-2.1 Site Survey.

Conduct a site survey to obtain information regarding the exterior fire alarm reporting system and adjacent structures. Information about adjacent structures must include; construction type, fire resistive rating of exterior walls, number of floors, area per floor, total building area, occupancy classification, and if the building is fully protected with an automatic fire sprinkler system.

3-2.2 Water Flow Testing.

Water flow testing of the existing water supply system(s) is required to determine the capability of the available water supply to support the expected demands. Perform testing in accordance with FM Global Property Loss Prevention Data Sheet 3-0. Provide a fire protection water flow test report in the Basis of Design. Refer to the following paragraph entitled “Water Supply Analysis” for further information.

3-2.3 Life Safety/Building Code Survey.

Projects involving renovations to existing facilities must include a survey to establish the existing conditions regarding compliance with current life safety code and building code requirements based on the intended use of the facility.

3-3 BASIS OF DESIGN.

This portion is critical to the understanding of the designer’s intent and methodology of design. Certain preliminary design information is critical to ensure the final documents are properly coordinated. The following is a guide to the minimum design analyses required at the earliest possible stage in design, but no later than the Design Development Submittal. This information is complementary to that specified by UFC 3-600-01 and must be provided for every project, whether it is new construction or a renovation project. All information must compare the required vs. the provided.

3-3.1 **Project Summary.**

Provide a brief summary of the project and scope of work. General information can be obtained from the DD 1391. Identify the purpose and use of the facility, including the following.

3-3.1.1 **Specific Hazards.** Identify all hazardous areas (chemicals, fuels, ordnance, etc.), processes, and special hazards requiring special fire protection considerations such as Radio Frequency (R-F) Shielded Rooms, Secured Rooms, Computer Rooms, commercial kitchen appliances, etc. Provide any relevant information pertaining to the hazards and how they are protected.

3-3.1.2 **Summary of Fire Protection Features.** Provide a brief summary of the active and passive features of fire protection. Description and location of all new and existing fire extinguishing and/or detection systems, fire alarm systems, fire pumps to be provided or existing to remain or modified.

3-3.1.3 **Summary of Existing Conditions.** Provide a brief summary of existing conditions impacting the project, such as existing detection/suppression systems or existing building construction features.

3-3.1.4 **Summary of Design Enhancements.** Specifically identify items the designer feels are enhancements in excess of the contract, criteria, and/or code requirements.

3-3.1.5 **Summary of Other Design Features.** Provide a brief summary of the other features of the design relevant to the fire protection of the project. Examples of "other features" include methodology for foam waste containment for foam systems, structural engineering evaluation of existing floor systems supporting gaseous agent or foam concentrate storage tanks, etc.

3-3.2 **Building Code Analysis.**

Include the following information: occupancy classification; height and area calculations (area per floor & total); type of construction; required building separation or exposure protection; rating of structural components; classification of interior finishes; location of fire-rated walls and partitions; description of construction; whether rated floor and roof assemblies are restrain or unrestrained; interior fire and/or smoke rated wall/partition requirements, fire rating of each floor, ceiling system, roofing system when applicable. Discuss if, and how the proximity to, and classification of adjacent structures factored into the analysis.

3-3.3 **Life Safety Code Analysis.**

Identify egress information, including the occupancy classification, number of exits, type of exits, exit travel distance, total exit width, total occupant load, common path of travel, etc.

3-3.4 Water Supply Analysis.

(This paragraph is only applicable to engineering services associated with preparing DD-1391s, design-bid-build projects and RFPs for design-build projects.) Provide a summary of the data obtained from the water flow test and determination of the adequacy of the water supply (even for facilities without sprinkler protection), along with sketches of the water distribution system. If fire flow demands cannot be met, cite the deficiencies and recommend design alternatives/solutions to correct the problem of an insufficient water supply (e.g., fire pump(s), and/or water storage tank(s), etc.).

3-3.4.1 **Hydraulic Supply Analysis.** Evaluating the available water supply is critical for buildings with and without sprinkler protection. Documents cannot be released for advertisement with expectations of the contractor determining the available water supply. The capability of the water supply to support the required fire flow demand must be confirmed **prior to advertisement**. The Fire Protection Designer of Record (FPDOR) is responsible for obtaining water distribution maps, establishing flow testing procedures and coordinating flow testing with the base fire department and public works. If the station does not allow contractors to conduct the flow tests, the station personnel can perform the flow test under the direct supervision of the FPDOR. The DOR must not, under any circumstance, rely on data from flow tests not supervised by an FPE. The FPDOR will be responsible for conducting the actual flow testing for facilities that are not on federal property. The FPDOR must graph the results for comparison with the anticipated hydraulic demand. This analysis is required for both sprinklered and non-sprinklered facilities.

3-3.4.2 **Water Supply Testing of Existing Water Distribution Systems.** Flow sufficient water to meet or exceed the combined sprinkler and hose stream demand. If the existing base water distribution system or dedicated fire main includes existing fire booster pumps, conduct testing with pump controller(s) configured based on activity policy for normal operating conditions. If there is a requirement for a redundant pump, disable one pump for the duration of the test. If, at the time of design, the booster pumps cannot be run and accurate flow testing cannot be conducted, include the following information in the contract documents:

a. All water distribution piping back to the booster pumps. Show the location of water supplies such as elevated water storage tanks.

b. Make, model, rated characteristics of each booster pump and the number of booster pumps expected to be operating based on the anticipated hydraulic demand. For stations with multiple pumps, confirm that one pump was designated “redundant” if there is a requirement for redundancy.

c. Available water supply (flow test data) at the suction side of the booster pump(s).

3-3.4.3 **Hydraulic Demand Analysis.** Calculate the “anticipated” demand of a facility to establish the minimum water supply required. Refer to UFC 3-600-01 for hazard classifications and design criteria determination.

For design-bid-build projects, provide proposed system layout with hydraulic sprinkler calculations, as required in NFPA 13 or other applicable criteria, of the expected demand area(s) to reflect the system demand. The calculations approximating the demand and pressure requirements are not acceptable. Only include proposed piping layout in the project development stage (35% drawings) as part of the submitted calculations.

3-3.4.4 **Evaluation of Hydraulic Supply Versus Demand.** Plot the available water supply versus the hydraulic demand on the Q1.85 Hydraulic Graph Paper. Present hydraulic information in graphical format as discussed in the FM Global Property Loss Prevention Data Sheet 3-0. If this evaluation determines the water supply can not support the anticipated demand, contact the cognizant AHJ as soon as possible. Provide appropriate supporting calculations and propose design options and/or alternatives for consideration.

3-3.5 **Water-based Fire Suppression Systems.**

Provide the following information as applicable.

3-3.5.1 **Description of Fire Suppression System(s).**

3-3.5.2 The area(s) that will be protected, the hazard classification of these area(s) and the type of system protecting these area(s).

3-3.5.3 The design density, demand area and hose stream allowance to be specified for each different area.

3-3.5.4 The method for connecting the suppression system to the fire alarm system, as well as the method of annunciating the systems and a description of any power disconnects, pre-alarms, etc. that will be required.

3-3.6 **Sketches.**

Where appropriate, provide sketches representing the water distribution system, sprinkler demand areas, show hydraulic reference points for the hydraulic sprinkler calculations, exiting information, travel distance, common path of travel, etc.).

3-3.7 **Existing Conditions.**

Provide detailed information on all existing fire detection and suppression systems for existing buildings (i.e., type of systems; area of coverage; make and model of all equipment; why system is or is not being replaced). For fire alarm systems, provide the following information (at a minimum): number of spare zones and spare spaces for modules, capacity of control panel(s), list of existing fire alarm zones, list of outputs, number of audio/visual circuits, standby battery capacity, indicate the working order of each system (condition and/or status), etc.

3-4 FIRE PROTECTION CALCULATIONS.

Provide calculations at the earliest possible stage in design, but no later than the Design Development Submittal.

3-4.1 Hydraulic Demand Analysis.

Calculate the fire flow demand for the facility. Provide calculations showing that the anticipated suppression systems and hose stream demands can be designed to the available water supply. For hydraulic calculations, deduct the hose stream requirement at the point of connection to the existing distribution systems or the closest fire hydrant; whichever is closer to the sprinkler riser/building.

3-4.1.1 **New Sprinkler Systems.** All facilities requiring sprinkler systems must be hydraulically designed. Refer to UFC-600-01 for hazard classifications and design criteria determination.

3-4.1.2 **Existing Sprinkler Systems.**

a. Establish if the existing system is hydraulically designed or a pipe schedule system. Information on an existing system may possibly be obtained from the base public works department or the fire department.

b. Hydraulically Designed Systems. Indicate the size and location of all cross and feed main piping from the point of connection to the existing system back to the sprinkler riser. All grid branch line piping must be indicated for grid systems. Identify the available water supply at the base of the riser. Do not assume the available water supply will be that identified with the existing design. Obtain current information.

c. Pipe Schedule Systems. Determine the hazard classification and whether the existing cross and feed mains, and the riser pipe sizes can support the new piping and sprinklers. Identify the size of the pipe at the point of connection. Identify all existing piping requiring replacement. Provide hydraulic calculations to ensure the system demand can meet the hazard it is protecting.

3-4.2 Fire Pumps.

Provide the following calculations verifying pump selection:

a. Calculations supporting selected rated capacity and pressure.

b. Power calculations for motor driven pumps.

c. Fuel supply calculations for engine driven pumps.

d. Calculations for suction supply tanks when applicable.

3-4.3 **Special Systems.**

3-4.3.1 **AFFF Extinguishing Systems.**

a. Include calculations for the foam concentrate quantity.

3-4.3.2 **Gaseous Fire Extinguishing Systems.**

a. Provide calculations verifying agent quantity, number of required tanks and intended tank location.

b. When systems are installed in existing facilities, ensure a structural analysis is provided for the intended tank location as required.

3-4.4 **Fire Alarm/Detection and Reporting Systems.**

3-4.4.1 **Modifications to Existing Systems.**

Provide a power supply analysis. Submit calculations for power supply and standby battery capacity requirements of existing system and new devices. Ensure the power supply is capable of supporting the electrical load of the new devices.

Provide a circuit analysis. Ensure the panel has the initiating and signaling expansion capabilities.

3-5 **CONTRACT DRAWINGS.**

Ensure contract drawings comply with UFC 1-300-09N, *Design Procedures.*

The following identifies some of the minimum information required on the contract drawings. The Navy project-reviewing engineer may identify additional required information. Items identified with "*" are required as a minimum for any Concept Design submittal and all following submittals. Items identified with a "**" are required as a minimum for any Design Development Submittal and all following submittals. Items with no asterisk notation are required for all Pre-final and Final submittals.

For Design-Build projects the Contractor is encouraged by RFP Section 01331 to include shop drawing level detail with the design submittal package. When this process is utilized, fire suppression and fire alarm/mass notification plan and detail sheets included with the Pre-Final and Final design submittal packages must be scaled no smaller than 1:100 or 1/8-inch. In addition to providing the information identified below, these drawings must also comply with the provisions of D40 and the applicable NFC pamphlet.

3-5.1 **Code Compliance Summary Sheet** (* applies to all elements listed below).

The Code Compliance Summary Sheet sheets must be prepared by the FPDOR and must immediately follow the title sheets. At a minimum, include the following information:

3-5.1.1 **Building Code Site Plan (Sketch) Identifying the Following.**

1. Line of encroachment identifying minimum separation distances from adjacent buildings and assumed property lines.
2. Building perimeter used for frontage increases.
3. Fire Department vehicle access to building.

3.5.1.2 **Building Code Summary Identifying.**

1. Classification of occupancy.
2. Allowed vs. provided type of construction.
3. Basic allowable heights & areas vs. actual heights & areas.
4. Allowable vs. provided height and/or area increases per floor and total.
5. Calculations supporting height and area modifications/increases.
6. Required vs. provided exterior exposure protection.
7. Required vs. provided interior fire rated occupancy separations.
8. Required vs. provided internal fire area separations.

3.5.1.3 **Life Safety Code® Summary Identifying.**

1. Classification of occupancy
2. Occupant load factor(s) and total calculated load;
3. Required vs. provided number of exits;
4. Required vs. provided capacity of means of egress
5. Required vs. provided arrangement of means of egress including remoteness of exits, horizontal exits, travel distance, common path of travel, dead-end corridor lengths
6. Required vs. provided discharge from exits;
7. Required vs. provided fire rated separation of exits and exit access;

8. Required vs. provided fire rated separation of hazardous areas;

9. Flam spread/smoke development ratings of interior finishes;

10. Requirements (if any) for smoke control systems based on the specific occupancy chapter and building design considerations;

11. Requirements for any special locking arrangements such as delayed-egress locks or access-controlled egress doors. Specify the rooms/area.

3.5.2 Life Safety Plans.

The Life Safety Plans must be prepared by the FPDOR and must immediately follow the title sheets and code compliance summary sheets. Scale the floor plans so the entire footprint fits on a single sheet provided that all information is clearly legible and the scale is no smaller than 1/16-inch (1:200). At a minimum, include the following information:

1. (**) Partition locations with fire rated partitions and horizontal exits identified.

2. (*) Building areas having different occupancy and hazard classifications.

3. Room numbers, corresponding occupancy classification and calculated occupant load.

4. Rooms and/or areas requiring special life safety and/or fire protection features.

5. (*) Egress travel requirements (travel distances, common paths of travel, dead-end corridors, etc).

6. Fire Extinguisher cabinet and surface-mounted fire extinguisher locations.

7. Fire Extinguisher type/quantity table identifying the total number and type of extinguishers required.

8. Location of primary fire alarm/mass notification control panel.

3-5.3 Fire Suppression Plans.

(*) Provide floor plans showing the following information. Scale the floor plan so the entire footprint fits on a single sheet provided that all information is clearly legible and the scale is no smaller than 1:200 or 1/16-inch.

Information pertaining to electronic control/release systems may be shown on the Fire Alarm/Mass Notification Systems drawings specified below.

1. (*) Hazard classifications. Where a facility has multiple hazard classifications, differentiate each classification area by border and/or hatching.

2. (*) Areas protected with special fire suppression systems.

3-5.3.1 **Fire Sprinkler Systems.** Provide the following information:

1. (**) Locations of sprinkler riser room.

2. (**) Fire department connections.

3. (**) Post indicator valves.

4. Isolation control valves.

5. Sprinkler branch lines or feed main piping if a specific routing is required i.e., single feed to computer room or elevator equipment room and hoistway.

6. (**) Location of control panels used for release of preaction or deluge systems

7. (**) Fire pump and associated equipment

3-5.3.2 **Gaseous Fire Extinguishing Systems.** Provide the following information:

1. (**) Outline of area/hazard to be protected.

2. (**) Location of storage cylinders and releasing panel.

3. (**) System initiating devices (manual releases, automatic detection devices, etc.).

4. Notification appliances.

5. Main/reserve transfer switches.

6. (**) Control devices such as dampers, shunt trip breakers for computer equipment shutdown, and air conditioning units to be shutdown, and electromagnetic door hold-open devices.

3-5.3.3 **AFFF Foam Systems.** Provide the following information:

1. (**) Outline of area/hazard to be protected.

2. (**) Locations of all risers, foam proportioning equipment, foam solution discharge devices, manual releases, optical detectors, control panel, pumps, concentrate tanks, test connections.

3-5.4 Fire Suppression Detail Sheets.

Provide fire suppression detail sheets showing the following information:

3-5.4.1 Fire Sprinkler Systems.

1. (**) Enlarged plan view of sprinkler riser room showing sprinkler risers, control valves, backflow prevention device and service entrance (supply) manifold drawn to scale.

2. Cross-sectional elevations of sprinkler and standpipe risers

3. (**) Enlarged plan view of fire pumps and piping arrangement, jockey pump, and associated controllers and equipment drawn to scale.

4. Cross-sectional elevations of fire pump supply and discharge piping arrangement.

5. (**) Releasing system riser diagram for preaction or deluge sprinkler systems. Identify all zones, circuit inputs and circuit outputs necessary for controls, including interconnection with building fire alarm control panel.

3-5.4.2 Gaseous Fire Extinguishing Systems.

1. (**) Releasing system riser diagram identifying all zones, circuit inputs and circuit outputs necessary for controls, including interconnection with building fire alarm control panel.

2. Elevation view of storage cylinders and manifold.

3. Isometric detail drawing of agent distribution piping including storage cylinder manifold and discharge nozzles.

4. (**) Sequence of Operation Matrix. See NFPA 72 for sample.

3-5.4.3 AFFF Foam Systems.

1. (**) Complete layout of the pump room showing location of fire and foam pumps, concentrate storage tanks, and all associated equipment drawn to scale.

2. (**) AFFF riser detail showing foam proportion method, test line connection, and all associated valves.

3. Details of AFFF discharge devices (i.e., foam makers, nozzles, etc).

4. (**) Releasing system riser diagram. Identify all zones, circuit inputs and circuit outputs necessary for controls, including interconnection with building fire alarm control panel.

5. (**) Isometric detail of foam concentrate delivery system showing concentrate piping, proportioning equipment, concentrate pumps and concentrate storage tank.

6. (**) Sequence of Operation Matrix. See NFPA 72 for sample.

3-5.5 Fire Alarm/Mass Notification System Plans.

Provide floor plans identifying location of field installed components and interconnected devices. Plans may identify fire suppression control/release system information identified above. At a minimum, identify the location of the following information.

1. (**) Control panel(s).

2. (**) NAC extender panels.

3. (**) Radio transmitter or master box.

4. (**) Line and low voltage surge arrestors.

5. (**) All initiating devices (including duct smoke detectors).

6. (**) All notification appliances.

7. (**) Supplemental equipment interfaced with the fire alarm system such as voice evacuation panels, electromagnetic door holders, delayed-egress or access-controlled doors, elevator system components, etc.

8. (**) Single station smoke detectors.

9. (**) Supplemental fire suppression equipment control panels such as fire/foam pump controllers, Fire suppression control/release panels.

3-5.6 Fire Alarm/Mass Notification System Detail Sheets.

Provide the following information. Detail sheets may identify fire suppression control/release system information identified above.

1. (**) Provide a riser diagram showing hierarchy, arrangement and zoning of the system. Identify all typical circuits, interconnections and interlocks necessary for associated controls. Do not identify every field device individually, such as smoke and heat detectors. Identify required line and low voltage surge arrestors. Interface with security systems for required delayed-egress or access-controlled doors. Identify interface with fire suppression control/release panels.

2. (**) Provide a Sequence of Operation Matrix. See NFPA 72 for sample.

3-6 SPECIFICATIONS.

Develop contract specifications using UFC 1-300-09N, *Design Procedures*.

ACRONYMS & ABBREVIATIONS

ABA	DoD Architectural Barriers Act (ABA) Accessibility Standard
ADAAG	Americans With Disabilities Act Accessibility Guidelines
AFFF	Aqueous Film-Forming Foam
AHJ	Authority Having Jurisdiction
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
CO_2	Carbon Dioxide
CPVC	Chlorinated Poly Vinyl Chloride
DLA	Defense Logistics Agency
DOD	Department of Defense
DODI	Department of Defense Instruction
DOR	Designer of Record
EM	Engineering Manual
FACP	Fire Alarm Control Panel
FM	Factory Mutual Global
FPE	Fire Protection Engineer
FPDOR	Fire Protection Designer of Record
IBC	International Building Code
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MIL-HDBK	Military Handbook
NAVFAC	Navy Facilities Engineering Command
NAC	Notification Appliance Circuit
NEMA	National Electrical Manufacturers Association
NFC	National Fire Code
NFPA	National Fire Protection Association
P.E.	Registered Professional Engineer
PIV	Post Indicator Valve
R-F	Radio Frequency
RFP	Request for Proposal
UFC	Unified Facilities Criteria
UL	Underwriters Laboratories Inc.
USC	United States Code

APPENDIX A REFERENCES

GOVERNMENT PUBLICATIONS:

1. Department of the Army

   Standardization Documents Order Desk
   700 Robbins Avenue, Bldg. 4D
   Philadelphia, PA 19111-5094

EM-385-1-1	*Safety and Health Requirements Manual*
TI 800-01	*Design Criteria, Appendix G*
TM 5-813-5	*Water Supply, Water Distribution, Volume 5*
AR 385-64	*Explosives Safety Program*
385-100	*Safety Manual*

2. Department of the Air Force

AFMAN 91-201	*Explosives Safety Standard*

3. Department of Defense

DODI 6055.9-STD	*DOD Ammunition and Explosive Safety Standards*

4. Department of the Navy

   Standardization Documents Order Desk
   700 Robbins Avenue, Bldg. 4D
   Philadelphia, PA 19111-5094

MIL-HDBK-1005/7	*Water Supply Systems*

MIL-HDBK-1191	*Medical and Dental Treatment Facilities Design and Construction Criteria*
MIL-HDBK 1037/4	*Brigs and Detention Facilities*
MIL-HDBK-1032/2	*Covered Storage*
MIL-HDBK-1005/13	*Hazardous Waste Storage Facilities*
MIL-HDBK-1025/1	*Piers and Wharves*
MIL-HDBK-1025/2	*Dockside Utilities for Ship Service*
MIL-HDBK-1025/6	*General Criteria for Waterfront Construction*
MIL-HDBK-1029/1	*Graving Drydocks*
MIL-HDBK-1029/3	*Drydocking Facilities Characteristics*
MIL-HDBK-1022A	*Petroleum Fuel Facilities*
UFC 1-300-09N	*Design Procedures*
UFC 3-200-10N	*Civil Engineering*
UFC 3-500-10N	*Electrical Engineering*
UFC 3-580-10	*Design: Navy and Marine Corps Intranet (NMCI) Standard Construction Practices*
UFC 3-600-01	*Fire Protection Engineering for Facilities*
UFC 4-010-01	*DoD Minimum Antiterrorism Standards for Buildings*
UFC 4-021-01	*Design and O&M: Mass Notification Systems*
UFC 4-150-02	*Dockside Utilities for Ship Service*
UFC 4-151-10	*Waterfront Construction*
UFC 4-740-14	*Child Development Centers*

MIL-F-24385F	*Fire Extinguishing Agent, Aqueous Film-Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater*
FED-STD-795	*Uniform Federal Accessibility Standard*

NAVSEA OP-5	*Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation, and Shipping*
DM-39	*Hyperbaric Facilities*
SS 521-AA-MAN-010	*U.S. Navy, Diving and Manned Hyperbaric Systems Safety Certification Manual*

5. Federal Laws

USC Title 10, Section 1794	*Military Child Care*
USC Title 15, Section 272	*Utilization of Consensus Technical Standards by Federal Agencies*
USC Title 15, Section 2225	*Hotel-Motel Fire Safety*
USC Title 15, Section 2227	*Fire Administration Authorization Act (also referred to as the "Fire Safety Act")*
ABA	*DoD Architectural Barriers Act (ABA) Accessibility Standard*
29 CFR 1910.109	*Explosives and Blasting Agents*

6. Office of Under Secretary of Defense

Memorandum dated 14 January 2002	*Guidance for Family Housing Master Plans*

NON-GOVERNMENT PUBLICATIONS:

7.	American National Standards Institute (ANSI) 1819 L Street, NW, 6th Floor Washington, DC, 20036	B1.20.1	*Pipe Thread*
8.	American Society for Testing and Materials (ASTM) 100 Barr Harbor Drive West Conshohocken, PA 19428	ASTM E 84	*Standard Method of Test of Surface Burning Characteristics of Building Materials*
		ASTM E 119	*Standard Test Methods for Fire Tests of Building Construction and Materials*
		ASTM E 136	*Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*
		ASTM E 814	*Standard Test Method for Fire Tests of Through-Penetration Fire Stops*
9.	American Water Works Association (AWWA) AWWA, 6666 W. Quincy Avenue Denver, CO 80235	Manual M14	*Recommended Practice for Backflow Prevention and Cross Connection Control*
		Manual M31	*Distribution System Requirements for Fire Protection*
10	International Code Council (ICC) 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041		International Building Code (IBC)

11. Factory Mutual Global (FM)

1301 Atwood Avenue
PO Box 7500
Johnston, RI 02919

FMDS	*All Factory Mutual Global Loss Prevention Data Sheets*

12. National Fire Protection Association (NFPA)

1 Batterymarch Park
Quincy, MA 02269-9101

NFPA	All Fire Codes, Standards, and Recommended Practices
NFPA	Handbook

13. Underwriters Laboratory (UL)

333 Pfingsten Road
Northbrook, IL 60062-2096

UL 790	*Safety Tests for Fire Resistance of Roof Covering Materials*
UL 1479	*Fire Tests of Through-Penetration Firestops*