

EVOLVING EXPECTATIONS: FIRE PROTECTION ENGINEERING IN MILITARY PROJECTS

SAME Tri-Regional JETS
Savannah, GA
26 June 2024



AGENDA

- ▲ Introductions
- ▲ Where have we been?
- ▲ Where are we now?
- ▲ Where are we going?
- ▲ Questions



WHO ARE WE? WHY LISTEN TO US?



THOMAS W. GARDNER, P.E, F.SFPE, LEED AP

- ▲ 43+ Years in Fire Protection Industry
- ▲ NFPA 99 Handbook Editor (5th & 6th Editions)
- ▲ Former NFPA 101 Technical Committee Member
- ▲ Fun Fact: Spent 4 days underwater on USS Oklahoma City

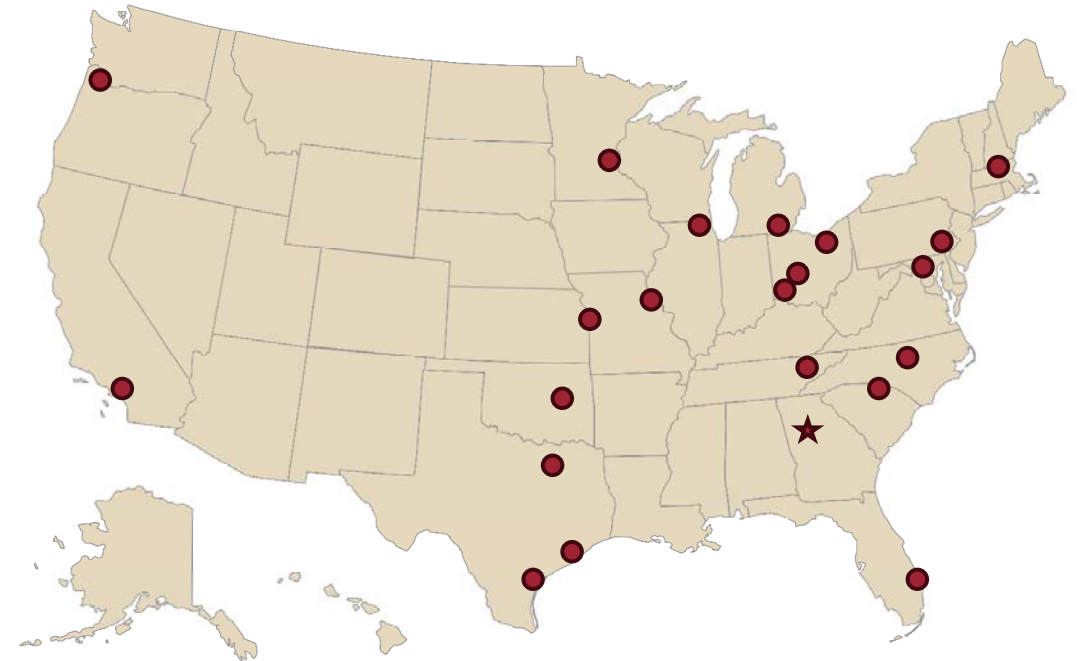


ZACH ATAIYAN, P.E.

- ▲ 10+ Years in Fire Protection industry
- ▲ M.S. FPE – Cal Poly
- ▲ Published Articles on Fire System Design and Testing
- ▲ Fun Fact: Father of 4 under 9.

HARRINGTON GROUP INC. OVERVIEW

- ▲ Founded in 1986 in Atlanta, GA
- ▲ Fire Protection Engineering Firm
- ▲ Small Business (22 QFPEs)
 - ▲ 55 Employees
- ▲ *Strong Core Values*
 - ▲ SERVICE
 - ▲ COMPETENCE
 - ▲ HONESTY
 - ▲ INTEGRITY
 - ▲ RESPECT



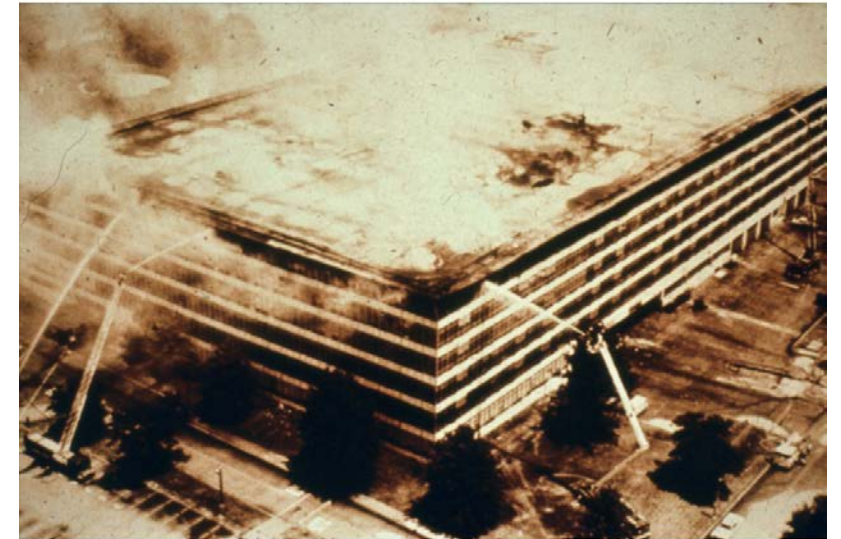


WHERE HAVE WE BEEN?

Credit: Wikipedia

HISTORY OF FPE IN DOD

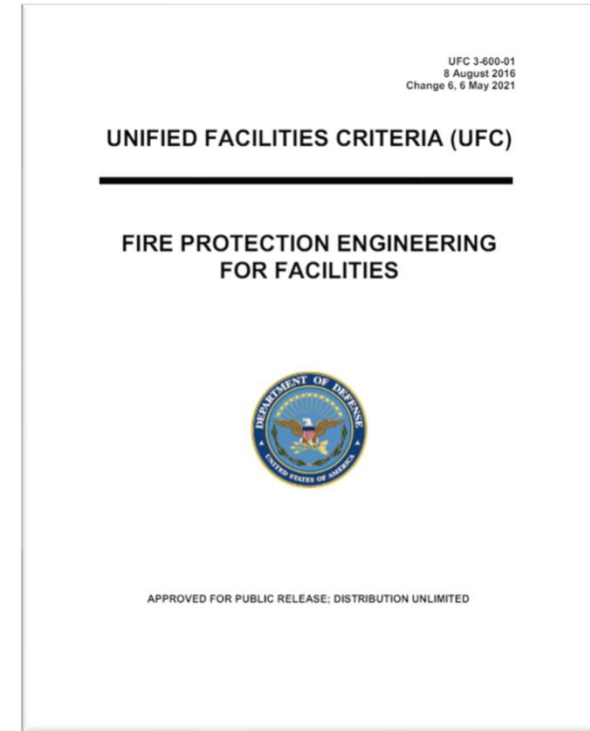
- ▲ FPE history in DoD
 - ▲ One of the first intelligent/addressable fire alarm systems was designed for the Warner Robins AFB Avionics Complex in 1984
 - ▲ Halon 1301 Clean Agent (phased out in 1987)
 - ▲ AFFF Low-Level Systems (phased out in 2020)
- ▲ No Significant Historical Fire Loss in DoD
- ▲ National Archives and Records Administration
 - ▲ July 12, 1973, a disastrous fire at the National Personnel Records Center (NPRC) destroyed approximately 16-18 million Official Military Personnel Files (OMPF)



Credit: ngef.org

EVOLUTION OF DOD FIRE PROTECTION STANDARDS

- ▲ Individual Branch Standards
 - ▲ Army: TM 5-812-1 – **1977-1985**
 - ▲ Navy: DM-8 – **1981-1985**
- ▲ MIL-HNBK 1008
 - ▲ **1985-2006**
 - ▲ Revisions A, B, C, D, and E
- ▲ UFC 3-600-01 Fire Protection Engineering
 - ▲ **2003 – Present (2016 ed. w/ change 6)**
 - ▲ *Rumor: New version to be released at any time.*



CLARIFICATION OF QFPE REQUIREMENT

- ▲ First Official FPE requirement in 1994
- ▲ 1994 – Mil-HDBK 1008B Introduces Qualifications for FPE – Broad Set of Quals
 - ▲ This requirement was refined through subsequent revisions
- ▲ 2016 – Revised UFC introduces “QFPE” Acronym.
 - ▲ Now only a permitted to be a licensed FPE through NCEES Exam
 - ▲ Construction: Army Requires QFPE to Prepare Working Drawings or have them prepared under immediate supervision.

WHERE ARE WE NOW?



Credit: HGI

WHERE ARE WE NOW?

- ▲ UFC 3-600-01 is the QFPE's starting point
- ▲ All Major Projects Require a Qualified Fire Protection Engineer ("QFPE")
- ▲ QFPE Defined:
 - ▲ Registered PE having passed the FPE NCEES exam, **AND**
 - ▲ Has Relevant Fire Protection Engineering Experience

1-7 FIRE PROTECTION ENGINEERING SERVICES.

1-7.1 General.

1-7.1.1 *Major Projects* require the design, review and oversight services of a QFPE. A QFPE must be involved in every aspect of the design, construction and testing/commissioning as it relates to fire protection and life safety. This includes, but is not limited to, building code analysis, life safety code analysis, design of automatic fire alarm, detection and suppression systems, water supply analysis, a multi-discipline review of the entire project, construction inspections and witnessing of fire protection acceptance testing/commissioning.

QFPE RESPONSIBILITIES

- ▲ Building Code and Life Safety Analysis
- ▲ Water Supply Analysis
- ▲ Fire Suppression and Fire Alarm System Design
- ▲ Involved through entire project
 - ▲ Typically, different QFPEs through different phases

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QFPE INVOLVEMENT IN A PROJECT – DESIGN-BID-BUILD

“DESIGN QFPE”

“CONSTRUCTION QFPE”

PLANNING

UFC 3-600-01 requires the contract document preparation include the requirement for a QFPE for design services in the statement of work.

DESIGN

The QFPE is responsible for all aspects of the Fire Protection and Life Safety design for a facility/project.

- Preliminary Calculations
- Life Safety Design Analysis and Plans
- Fire Suppression Drawings and Specs
- Fire Alarm/MNS Drawings and Specs

CONSTRUCTION

A QFPE is required during construction and their responsibilities vary depending on the executing agency.

Army – QFPE Responsible for preparation of working drawings and Installation QC

Navy – QFPE Responsible for Design and Installation QC

QFPE INVOLVEMENT IN A PROJECT – DESIGN-BUILD

“RFP-QFPE”

RFP DEVELOPMENT

The QFPE is responsible for capturing and coordinating the Fire Protection and Life Safety design requirements into the RFP specifications for a facility/project.

“DESIGN-BUILD QFPE”

DESIGN & CONSTRUCTION

This QFPE is responsible for all aspects of the Fire Protection and Life Safety design and construction for a facility/project. The same QFPE is responsible design criteria drawings, coordination with the subcontractors' designs, construction surveillance, and observing preliminary and final acceptance testing.



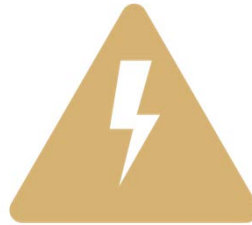
Credit: Reuters

WHERE ARE WE GOING?

EMERGING FIRE PROTECTION ENGINEERING TRENDS



Hangar Fire Suppression
Developments



Electrification/Decarbonization
Fire Considerations



Construction Phase Fire
Protection Quality Control

HANGAR FIRE SUPPRESSION - RECAP



FY 2020 NDAA Section 322

“(a) (1) MILITARY SPECIFICATION.—Not later than January 31, 2023, the Secretary of the Navy shall publish a military specification for a fluorine-free fire-fighting agent for use at all military installations”

New MILSPEC

by Jan 31, 2023

“(b) LIMITATION.—No amount authorized to be appropriated or otherwise made available for the Department of Defense may be obligated or expended after October 1, 2023, to procure fire-fighting foam that contains in excess of 1 part per billion of perfluoroalkyl substances and polyfluoroalkyl substances.”

Cannot purchase

foam with >1ppb PFAS

after Oct 1, 2023

“(c) PROHIBITION ON USE.— Fluorinated aqueous film-forming foam may not be used at any military installation on or after the earlier of the following dates:

Cannot use

PFAS AFFF

after Oct 1, 2024*

*SECDEF may grant two
1-year extensions = 2026

(1) October 1, 2024.

(2) The date on which the Secretary determines that compliance with the prohibition under this subsection is possible.”

SUPPRESSION DIRECTIVES BY BRANCH

Air Force	“2021 Sundown Policy on Foam Suppression Systems” • Driven by a Risk Assessment, not PFAS concern Current Directive: Water-only sprinkler systems in the hangar bay with fire detection.
Navy	Initial Guidance was turn off AFFF Low level (Trench Nozzle) Systems
Army	Directive: Drop-in replacement of existing AFFF with Mil-Spec 3F foam
Marines	Initial Directive: Turn off Foam Systems Current Directive: Provide a Code Compliant Solution (ILDFA or SFFF)

UPDATED/NEW REQUIREMENTS ON HORIZON

- ▲ Ignitable Liquid Drainage Floor Assembly (“ILDFA”)
- ▲ Tensioned Fabric Membrane Structures for Hangars
 - ▲ Appealing for rapid deployment
 - ▲ Risk of physical damage
- ▲ NAVFAC
 - ▲ Developing Updated Hangar FP Requirements based on engineering analyses
 - ▲ Published guidance in 1-2 years



SAFESPILL

Credit: Safespill

ELECTRIFICATION/DECARBONIZATION

- ▲ Fleet Electrification Mandate = EV Charging Infrastructure en Masse
- ▲ Microgrids on an Installation Level = Battery Energy Storage Systems
 - ▲ Improved Resilience and Carbon Reduction
- ▲ Mission Batteries and Micro-Mobility = Dispersion of Battery Hazards



Credit: GM Defense

ELECTRIFICATION FIRE PROTECTION CONSIDERATIONS

- ▲ Lithium-Ion Batteries are the hot topic in the FPE industry
- ▲ Outside of the Federal world:
 - ▲ NFPA 855 – Standard for the Installation of Energy Storage Systems
 - ▲ UL 9540A - Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- ▲ Guidance is evolving with commercial guidance (FM Global)



CURRENT BATTERY UFC REQUIREMENTS



Electrical UFCs

(UFC 3-520-01 and UFC 3-520-05)

Prohibits lithium batteries for stationary applications in occupied facilities.

Preferred location for charging Mission Batteries:

- Unoccupied, segregated building, or
- Dedicated room within occupied building, fire rated, with two means of egress and panic hardware.



Fire Protection UFC

(UFC 3-600-01 w/Change 6, May 2021)

Latest version provides guidance for Lithium BESS installations

- Follow NFPA 855 and UFC 3-600-01
- Guidance for Unoccupied and Occupied Structures
- NFPA 855 includes numerous analysis and documentation requirements to quantify the risk of the installation. **This will add QFPE Scope to design.**

UFC GUIDANCE WILL CONTINUE TO EVOLVE

ARMY/USACE OUTLOOK



Credit: Army.mil

- ▲ “*Big Changes are Coming*” – John Wilkus, USACE
- ▲ Army’s electrification initiatives on the:
 - ▲ Micro Level – Mission Batteries, Personal Micromobility, Fleet electrification
 - ▲ Macro Level – BESS in Occupied Buildings, Fleet Electrification
 - ▲ Utility Scale – Large-scale BESS Installations

NAVY/NAVFAC OUTLOOK

- ▲ Evolving Microgrid Facilities and Deployments on a larger scale
 - ▲ Old battery technologies to be replaced with Li-Ion (Big concern).
- ▲ Seeing impacts of Mission Battery implementations
 - ▲ UAVs/UUVs and ASDS
 - ▲ How to limit risk with mission battery charging?
- ▲ Anticipate Microgrid/BESS will introduce newer battery tech



Credit: greentechmedia.com



Credit: Military.com



FIRE PROTECTION QUALITY CONTROL

- ▲ “80% of Fire Protection Final Acceptance Tests Fail”
 - NAVFAC
- ▲ UFC 3-600-01 Requires a QFPE to be involved in all phases of Design and Construction
- ▲ Division 21 and 28 include requirements for a QFPE during construction
- ▲ **A Scope Gap is Created**
 - ▲ This leaves the FPE portions of Div 07, Div 08, Div 10, and Div 33 out of the QFPE’s contract.

What’s the Big Deal with Quality Control Anyways?



Photo Credit: NAVFAC/USACE



Photo Credit: NAVFAC/USACE



Photo Credit: NAVFAC/USACE

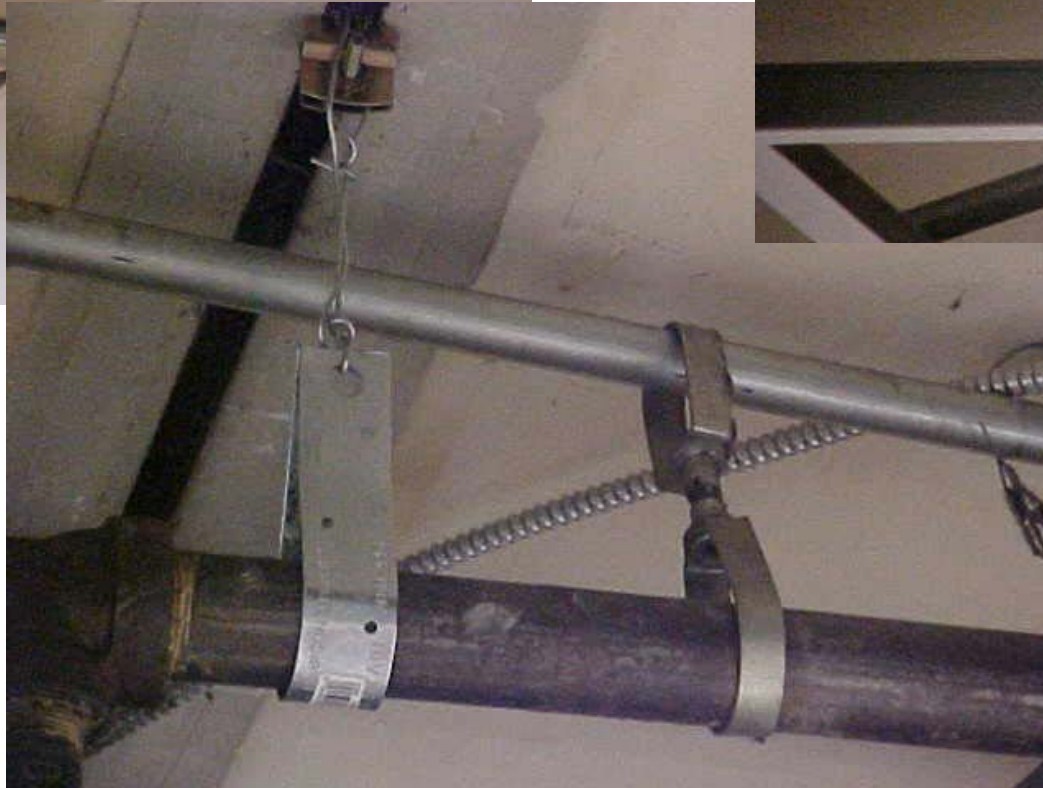


Photo Credit: NAVFAC/USACE

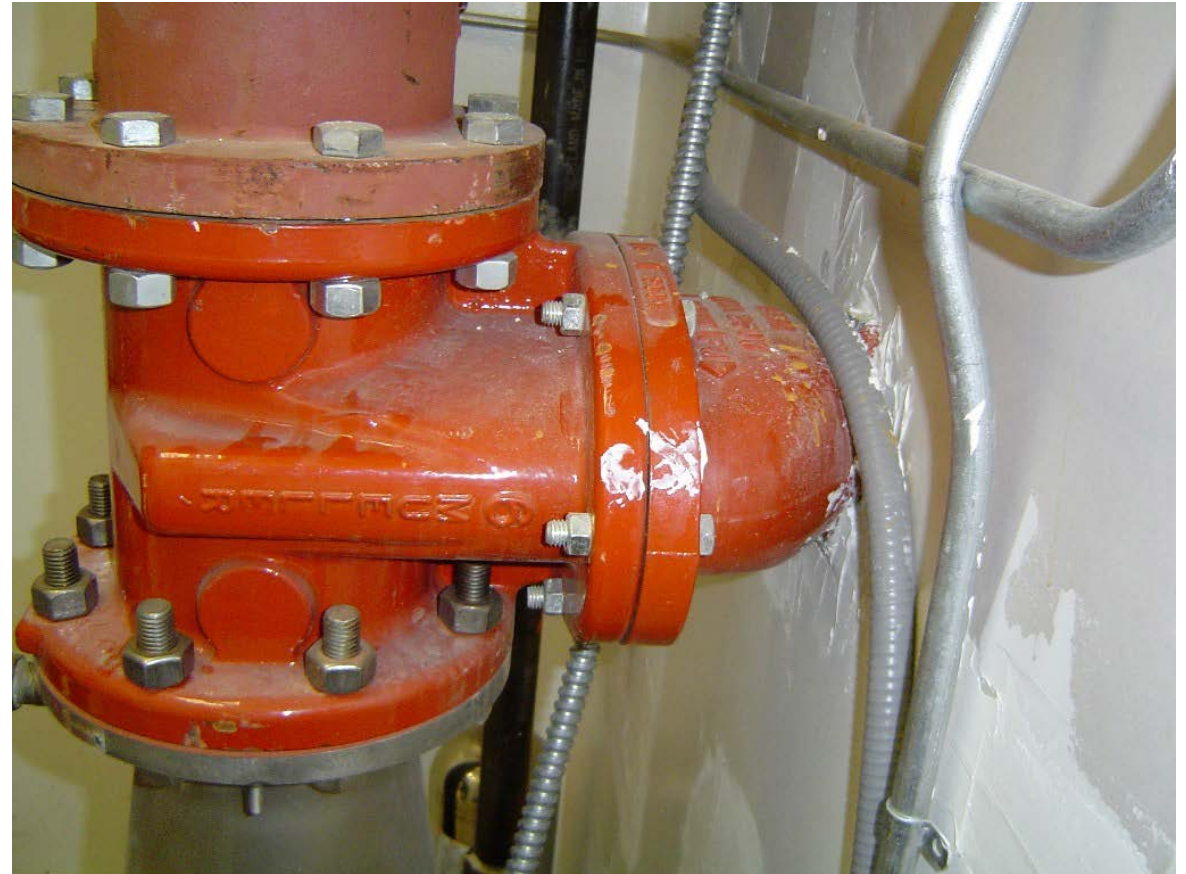


Photo Credit: NAVFAC/USACE

COMMON FP QC ISSUES ACCORDING TO NAVFAC

Shop drawings don't match installed conditions.

The fire alarm system installation is not complete.

The fire pump test will not meet the manufacturer's bench test curve.

The base-wide fire reporting system has not been programmed.

The MNS messages don't work properly.

Device mounting heights are incorrect.

The battery calculations are based on device counts and layouts that do not match field conditions.

The wiring and conduit installation is non-NEC compliant or not in accordance with the RFP/specifications.

Subcontractors are unfamiliar with the specifications for that job.

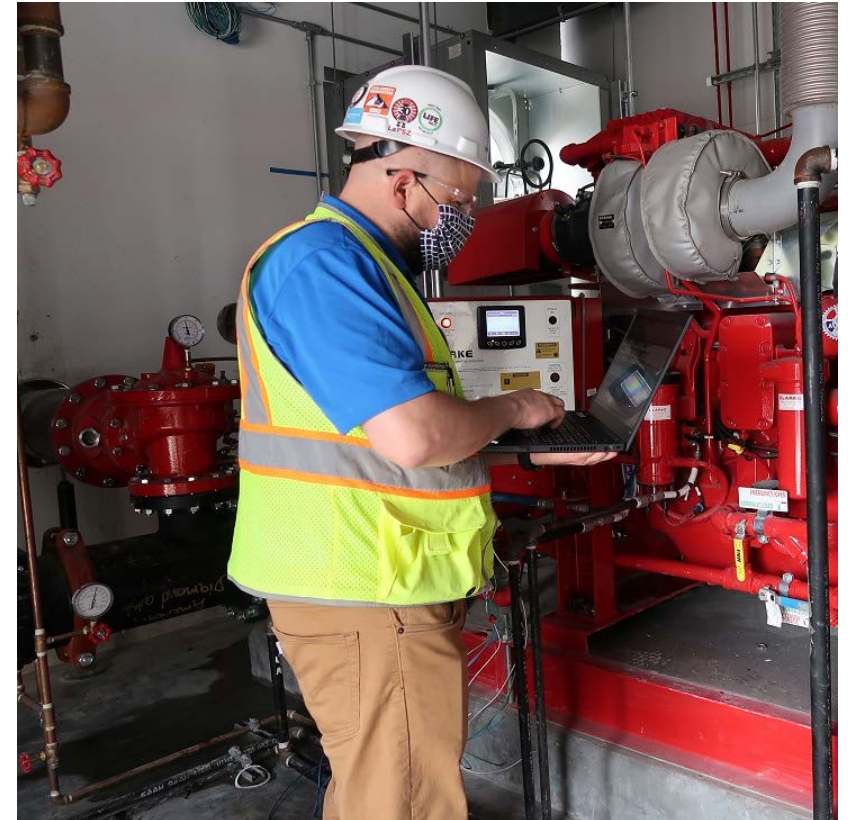
Shop Drawings have yet to be approved.

01 45 00 – QUALITY CONTROL

- ▲ August 2023 version unified the three specs from Army/Navy/Air Force
- ▲ New Role Defined: Fire Protection QC Specialist - “FPQC”
- ▲ Design Considerations – Use most recent spec from wbdg.org.
 - ▲ The latest version includes the FPQC requirement.
 - ▲ The FPE Designer of Record has Additional Responsibility:
 - ▲ “Schedule of Fire Protection System Inspections by the FPQC Specialist”
- ▲ Construction Considerations – **Closes the QFPE Scope Gap**

FPQC QUALIFICATIONS DEFINED

- ▶ Registered FPE in U.S., Having Passed NCEES exam in FPE
- ▶ Minimum 5 years of FPE experience in projects of similar Relevance and Complexity
- ▶ No other contractual obligations to the Prime or Subcontractors
 - ▶ Not on the sprinkler or alarm subcontractors' teams
- ▶ Up to 5 Employees of an Independent Engineering Firm or Company
 - ▶ For NAVFAC Design-Build: The FPE on the Prime's design team is the FPQC.



FPQC RESPONSIBILITIES

- ▲ Participate in QC Plan Development and QC Meetings
- ▲ Review and Certify Fire and Life Safety Submittals are Complete + Accurate **before** submittal to the Gov.
 - ▲ Firestopping
 - ▲ Opening Protectives
 - ▲ Fire Extinguishers
 - ▲ Fire Suppression (Sprinklers, fire pumps, Special extinguishing)
 - ▲ Fire Alarm/Mass Notification Systems
 - ▲ Fire Water Storage Tanks, Underground Water Piping and Appurtenances.
- ▲ Perform Construction Surveillance per Schedule of FP System Inspections
- ▲ Document inspection results daily as inspections are performed.

SCHEDULE OF FP SYSTEM INSPECTIONS BY FPQC

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

1. INSTRUCTIONS for FPQC Specialist:

Perform surveillance of fire protection system installation during construction and during pre-final and final acceptance inspections. Surveillance includes either visual inspections or observations performed by the FPQC as indicated in the following Schedule of Fire Protection System Inspections. Check boxes in the schedule indicate the inspections or observations that are applicable to this project, which must be performed and documented by the FPQC.

Surveillance of fire protection system inspections is divided into three phases:

Surveillance During Construction – Includes periodic on-site visits by the FPQC during construction

Pre-Final Acceptance Inspection – FPQC must be onsite during pre-final acceptance inspection

Final Acceptance Inspection – FPQC must be onsite during final acceptance inspection

2. INSPECTION TYPE

VISUAL INSPECTION:

Perform on-site visual inspections as indicated in the Schedule of Fire Protection System Inspections as construction progresses to confirm work conforms with the contract requirements including but not limited to verifying proper installation of equipment and materials in accordance with applicable codes. Where work will be covered up by finished walls and ceilings, inspections must be scheduled and performed when work is still visible.

OBSERVATION:

Observe component and system testing in person on-site as indicated in the Schedule of Fire Protection System Inspections. Confirm testing is completed in accordance with applicable codes and that testing was successful.

DOCUMENTATION:

Document all inspections and observations in the FPQC Report in accordance with UFGS 01 45 00. Document any deficiencies and all work observed that has been successfully performed in accordance with the contract documents. Record deficiencies in the rework list.

DESIGNER NOTES (delete this box after reviewing):

Rev 2-14-23

1. Fire Protection DOR must edit this schedule based on the project scope.
2. Indicate inspection and observation tasks applicable to your project that are to be performed by the FPQC by checking boxes next to each task required. Either delete unchecked sections or leave them in the schedule unchecked.
3. This schedule does NOT need to be printed in color.
4. When finished editing, delete this note box and save this schedule as a PDF and insert into the project specifications immediately following UFGS Section 01 45 00.

1

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

SURVEILLANCE DURING CONSTRUCTION

TASK	INSPECTION TYPE	DESCRIPTION
Installation of service main and risers, thrust blocks, tie-in to above ground	☒ VISUAL INSPECTION	☒ Visually inspect materials ☒ Visually inspect installation
Orientation of fire department access	☒ VISUAL INSPECTION	☒ Visually inspect installation and orientation
Installation of interior attachments, coatings, tie prior to filling fire water tank	☒ VISUAL INSPECTION	☒ Visually inspect fire protection water tank installation
Backflow test for underground	☒ OBSERVE	☒ Verify proper test method ☒ Confirm test was successful
Backflow test for above ground	☒ OBSERVE	☒ Verify proper test method ☒ Confirm test was successful
System flush prior to the riser	☒ OBSERVE	☒ Verify system was properly flushed
Test for Backflow	☒ OBSERVE	☒ Verify proper test method ☒ Confirm test was successful
Flush prior to fire pump	☒ OBSERVE	☒ Verify system was properly flushed
Test fire pump suction and discharge	☒ OBSERVE	☒ Verify proper test method ☒ Confirm test was successful
Startup	☒ OBSERVE	☒ Confirm successful startup
Installation of sprinkler wall or ceiling	☒ VISUAL INSPECTION	☒ Inspect pipe hangers, bracing, sprinkler heads ☒ Inspect for sprinkler obstructions; damaged, painted or covered heads ☒ Verify proper location of control valves, drains, vents, backflow, test header ☒ Verify proper component mounting heights
Sections and in FPQC Report	☒ DOCUMENT	☒ Submit report for each day inspections or observations occur ☒ Annotate deficiencies and satisfactory work observed ☒ Record rework items in FPQC report

2

PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

INSPECTION TYPE	DESCRIPTION
☒ VISUAL INSPECTION	☒ Inspect gas cylinders, initiating controls, shutdowns, aborts, and visual warning
☒ VISUAL INSPECTION	☒ Inspect detector and nozzle layout ☒ Inspect for obstructions, abort stations ☒ Inspect riser piping
☒ VISUAL INSPECTION	☒ Inspect elevator recall functions ☒ Inspect two-way communication
☒ VISUAL INSPECTION	☒ Inspect location of sprinkler piping and sprinklers
☒ DOCUMENT	☒ Submit report for each day inspections or observations occur ☒ Document deficiencies and satisfactory work observed in FPQC Report ☒ Record deficiencies in rework list

INSPECTION TYPE	DESCRIPTION
☒ VISUAL INSPECTION	☒ Inspect partitions for proper fire rated construction per design ☒ Inspect doors and door hardware for proper fire rating ☒ Inspect glass for proper fire rating
☒ VISUAL INSPECTION	☒ Inspect for use of proper fireproofing materials ☒ Inspect for cracking, spalling or delaminating ☒ Inspect for proper application thickness
☒ VISUAL INSPECTION	☒ Inspect to confirm firestopping system is UL tested or an engineering judgement has been obtained and submitted ☒ Inspect for use of proper firestopping materials ☒ Inspect penetrations through fire rated walls, partitions and ceilings ☒ Inspect construction joints and gaps
☒ DOCUMENT	☒ Submit report for each day inspections or observations occur

3

PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

☒	☒ Document deficiencies and satisfactory work observed in FPQC Report ☒ Record deficiencies in rework list
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INSPECTION TYPE	DESCRIPTION
☒ VISUAL INSPECTION	☒ Inspect conduit, wiring, conduit fill, wire type ☒ Inspect installation heights of back boxes
☒ DOCUMENT	☒ Submit report for each day inspections or observations occur ☒ Document deficiencies and satisfactory work observed in FPQC Report ☒ Record deficiencies in rework list

PRE-FINAL INSPECTION	
INSPECTION TYPE	DESCRIPTION
☒ VISUAL INSPECTION	☒ Verify proper installation of fire protection and life safety systems
☒ OBSERVE	☒ Verify proper testing is performed on fire protection and life safety systems
☒ VISUAL INSPECTION	☒ Document deficiencies in FPQC Report and record in rework list
☒ VISUAL INSPECTION	☒ Record re-inspection results on FPQC Report
☒ DOCUMENT	☒ Document results of pre-final inspection in FPQC Report
☒ DOCUMENT	☒ Provide separate letter certifying conformance with contract requirements

FINAL INSPECTION	
INSPECTION TYPE	DESCRIPTION

PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

☒ VISUAL INSPECTION	☒
☒ DOCUMENT	☒ Document deficiencies identified by Government FPE on deficiency list
☒ VISUAL INSPECTION	☒ Inspect rework to confirm all deficiencies have been corrected
☒ DOCUMENT	☒ Document inspection results on FPQC Report

FPQC VS QFPE

- ▲ NAVFAC:
 - ▲ FPQC = QFPE
- ▲ USACE:
 - ▲ QFPE is responsible for preparation of Shop Drawings (“Immediate Supervision”)
 - ▲ The FPQC can be the QFPE. BUT – The QFPE cannot always be the FPQC
 - ▲ If the QFPE is an employee of the FP Contractor.



USACE AND NAVFAC FPE INSIGHT



- ▲ We interviewed FPEs from USACE and NAVFAC
- ▲ Their feedback for industry:
 - ▲ “GET THE FPE INVOLVED EARLIER”
 - ▲ Specifically in Construction
 - ▲ Navy: FC 1-300-09N has additional responsibilities for the FPE.
 - ▲ “Ideas are fixed for free, and paper fixed for cheap. Once things are constructed, it’s sometimes impossible to fix.”

QUESTIONS?

▲ Thank you!



CONTACT



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