

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE	PAGE 1 OF 71 PAGES
2. AMENDMENT/MODIFICATION NO. AMENDMENT NO. 0001		3. EFFECTIVE DATE 09/08/09	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable) 09-0203
6. ISSUED BY CODE sgj Officer in Charge of Construction MCI-East 1005 Michael Road Camp Lejeune, NC 28547-2521		7. ADMINISTERED BY (If other than Item 6) CODE See Item 6		
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)			(X)	9A. AMENDMENT OF SOLICITATION NO. N40085-09-R-0203
			X	9B. DATED (SEE ITEM 11) 09/08/09
				10A. MODIFICATION OF CONTRACT/ORDER NO.
				10B. DATED (SEE ITEM 11)
CODE	FACILITY CODE			

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended.
 Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
 (a) By completing items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted;
 or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

N40085-09-R-0203, P715 CDC Addition, MCAS New River

~SEE CONTINUATION SHEETS 2-71~

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR		16B. UNITED STATES OF AMERICA	
15C. DATE SIGNED		16C. DATE SIGNED	
(Signature of person authorized to sign)		(Signature of Contracting Officer)	

**Construct Addition
MCAS New River, CDC
P-715
Amendment #1**

9-3-09

This amendment is in response to the final review comments.

Section 32 31 13 Chain Link Fence and Gates;

Deleted from the Table of Contents and from the specifications.

Section 01 14 00 Work Restrictions;

At the end of paragraph 1.2.4 add the following: “Temporary partitions, as located on project drawings, shall be constructed to secure existing facility prior to any other work taking place. The partitions shall be dust proof and weather proof and shall protect the occupants of the facility from danger and/or the environmental hazards. Also they shall prevent entry to the existing facility. The interior side of the temporary partitions shall have a finished appearance with “Do Not Enter” safety signage attached. The partitions are to be maintained through out construction, and shall be removed and disposed of as directed by the Contracting Officer.”

Specification Section 22 00 00 PLUMBING, GENERAL PURPOSE

Section 1.2 Submittals:

Add:

SD 02 Shop Drawings

Plumbing Systems; G,

Detail drawings consisting of schedules, performance charts, instructions, diagrams and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams for connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposes support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Section 2.4 Fixtures

Delete paragraph 2.4.1 Lavatories

Specification 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS

Add New River Mechanical Policies as follows to the end of the section:

NEW RIVER POLICIES – MECHANICAL CONCERNS

1. MCAS New River Planning is separate from Camp LeJeune.
2. The Air Station's steam distribution system has a median high pressure of 150 psi. Pressures have gone as high as 160 psi. The minimum steam pressure is 80 psi.
3. FRP pipe should not be used for buried steam condensate lines. Use schedule 80 black steel pipe.
4. Minimize the use of steam manholes. Those that must be used are to be raised 18" above finish grade and provided with a full grated top.
5. Steam condensate receiver pumps should be steam pressure powered. Do not use electric duplex condensate pumps. Base maintenance electrical and mechanical trade responsibilities overlap when servicing electric condensate pumps; single trade responsibility is desired.
6. Equip steam manholes with steam ejector pumps.
7. New River has a "Green Zone" policy that determines use of above or below grade steam distribution. This zone is generally any area in the proximity zone of the BEQ area. The former right-of-way for the SEABOARD COAST RAILROAD that runs approximately north south, establishes an approximate boundary of this "Green Zone". West of the right-of way, all steam lines must generally be below grade. Contact Mr. Jerry Harper, MCAS N.R. facilities planning phone (919) 451-6505 for direction on a case-by-case basis.
8. New River's future expansion of below grade steam lines will utilize a trench system with removable tops that can double as sidewalks. High groundwater may require partial burial of the trenches with backfilled berms.
9. All equipment within mechanical rooms should be accessible for maintenance and removable with minimal disruption.
10. Avoid rooftop equipment.
11. Avoid use of cooling towers.

12. HVAC equipment should not be installed in attics, overhead or above suspended ceiling unless absolutely necessary. When dictated by necessity, provide access and floor space for maintenance.
13. Provide separate mechanical and electrical rooms with exterior, ground level entrances, if possible.
14. Avoid use of economizers (dry bulb or enthalpy). High humidity and poor control reliability prohibit successful use.
15. Do not install steam pits within mechanical rooms.
16. Avoid the use of chilled water fan coil (FCU) systems. FCU's provide poor humidity control.
17. Pneumatic control systems are trouble-prone and should not be used. DDC controls are desired.
18. Provided auxiliary coil drain pans below all cooling equipment installed above ceilings.
19. Avoid the use of space heating hot water reset; control reliability has been a problem.

Section 23 05 93.00 22 HVAC TESTING/ADJUSTING/BALANCING FOR SMALL SYSTEMS

PART 1 GENERAL
(Section 1.1 REFERENCES)

Change NEBB TABES date from 1998 to 2005, 7th edition.

SECTION 23 07 00.00 MECHANICAL INSULATION

PART 3 EXECUTIONS, Paragraph 3.2.1.1
Delete "Heating Hot Water Piping, and"

SECTION 23 09 23 DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS

Section 1.4 Submittals:

SD-02 Shop Drawings

Add a “G” after DDC Contractor Design Drawings, Draft As-Built Drawings and Final As-Built Drawings

SD-03 Product Data

Add a “G” after Manufacture’s Catalog Details, Programming Software, GPPC Application Programs, XIF files and LNS Plug-in.

SD-06 Test Reports

Add a “G” after Start-up and Start-up Testing Report, PVT Procedures, PBVT Report, Pre-Construction QC Checklist and Post-Construction QC Checklist.

SD-10 Operation and Maintenance Data

Add a “G” after Operation and Maintenance (O&M), Training Documentation.

SD-11 Closeout Submittals

Add a “G” after Closeout QC Checklist.

Section 3.2 Control System Installation

Add paragraph 3.3.22.5 Connection to Ductwork

Connections to sensing elements in ductwork shall be plastic tubing.

Section 3.3 HVAC Systems Operation

Paragraph 3.3.1.1 Single Zone with Heating and DX Cooling Coils

d. Modify to read d. Proofs.

Section 28 31 76 Interior Fire Alarm System;

The attached specification replaces the content in the project Table of Contents.

The attached Code Analysis and Fire Protection Analysis is to replace the submitted Code Analysis and Fire Protection Analysis.

Section 03 30 53 Miscellaneous Cast in Place Concrete;

The attached section, 03 30 00 cast in Place Concrete, replaces 03 30 53 miscellaneous cast in Place Concrete in the Table of Contents and the body of the specifications.

Section 12 21 00 Window Blinds

The attached section, 12 21 00, window blinds is to be added to the Table of Contents and the body of the specifications.

On NAVFAC Dwg. No.12549362 (FA001)

Fire Alarm Legend; Supplemental information has been added.

On NAVFAC Dwg. No.12549363 (FA101)

First Floor Fire Alarm Plan- West; Supplemental information has been added.

On NAVFAC Dwg. No.12549364 (FA102)

First Floor Fire Alarm Plan- East; Supplemental information has been added.

On NAVFAC Dwg. No.12549307 (CS 101)

Site Improvement Plan; Structure and pipe data has been modified.

On NAVFAC Dwg. No.12549308 (CS 102)

Site Improvement Plan; The note "Fall Ditch" has been deleted.

On NAVFAC Dwg. No.12549309 (CS 103)

Drainage Improvement Plan; This sheet replaces previous submitted sheet CS 103 in it's entirety.

On NAVFAC Dwg. No.12549313 (CS 502)

Erosion & Sediment Control Details; A detail has been deleted.

On NAVFAC Dwg. No.12549315 (CS 504)

Details; Details have been modified.

On NAVFAC Dwg. No.12549316 (CS 505)

Details; A detail to the outlet structure has been modified.

SECTION 03 30 00

CAST-IN-PLACE CONCRETE
01/08

PART 1 GENERAL

1.1 REFERENCES

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.

ACI INTERNATIONAL (ACI)

- ACI/MCP-1 (2009) Manual of Concrete Practice Part 1:
ACI 104-71R-97 to 223-98
- ACI/MCP-2 (2009) Manual of Concrete Practice Part 2
- ACI 224R-01 to ACI 313R-97
- ACI/MCP-3 (2009) Manual of Concrete Practice Part 3
- ACI 315-99 to ACI 343R-95
- ACI/MCP-4 (2009) Manual of Concrete Practice Part 4
- ACI 345R-05 to 355.2R-04

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

- AASHTO M 322M/M 322 (2007) Standard Specification for
Rail-Steel and Axle-Steel Deformed Bars
for Concrete Reinforcement

ASTM INTERNATIONAL (ASTM)

- ASTM A 185/A 185M (2007) Standard Specification for Steel
Welded Wire Reinforcement, Plain, for
Concrete
- ASTM A 496/A 496M (2007) Standard Specification for Steel
Wire, Deformed, for Concrete Reinforcement
- ASTM A 497/A 497M (2007) Standard Specification for Steel
Welded Wire Reinforcement, Deformed, for
Concrete
- ASTM A 615/A 615M (2008b) Standard Specification for
Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement
- ASTM A 82/A 82M (2007) Standard Specification for Steel
Wire, Plain, for Concrete Reinforcement
- ASTM A 996/A 996M (2006a) Standard Specification for
Rail-Steel and Axle-Steel Deformed Bars or
Concrete Reinforcement

ASTM C 1017/C 1017M	(2007) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1107/C 1107M	(2008) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1260	(2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 143/C 143M	(2008) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 1567	(2008) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C 171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(2008) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	(2008a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(2007) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(2008c) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2006) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 295	(2008) Petrographic Examination of Aggregates for Concrete
ASTM C 309	(2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2008b) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 311	(2007) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
ASTM C 33/C 33M	(2008) Standard Specification for Concrete Aggregates

ASTM C 39/C 39M	(2005e1e2) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(2004) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 494/C 494M	(2008a) Standard Specification for Chemical Admixtures for Concrete
ASTM C 595	(2008a) Standard Specification for Blended Hydraulic Cements
ASTM C 618	(2008a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 94/C 94M	(2009) Standard Specification for Ready-Mixed Concrete
ASTM C 989	(2009) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³)
ASTM D 2103	(2008) Standard Specification for Polyethylene Film and Sheeting
ASTM D 4397	(2008) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 5759	(1995; R 2005) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM E 329	(2008) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP (2001; 27Ed) Manual of Standard Practice

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS UU-B-790 (Rev A) Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland

cement, pozzolan, fly ash, ground granulated blast-furnace slag, and silica fume.

- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings for concrete formwork must be submitted by the Contractor in accordance with paragraph entitled, "Shop Drawings," of this section, to include the following:

Reinforcing steel; G

Reproductions of contract drawings are unacceptable.

SD-03 Product Data

Materials for curing concrete
Joint sealants;

Submit manufacturer's product data, indicating VOC content. Manufacturer's catalog data for the following items must include printed instructions for admixtures, bonding agents, epoxy-resin adhesive binders, waterstops, and liquid chemical floor hardeners.

Joint filler;
Recycled Aggregate Materials;
Cement;
Portland Cement
Ready-Mix Concrete
Water-Vapor Barrier Subgrade Cover
Concrete Curing Materials
Reinforcement Materials

SD-05 Design Data

Concrete mix design; G

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, ground slag, and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which produce a range of strength encompassing those required for each class and type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submit copies of the fly ash, and pozzolan test results, in addition. The approval of fly ash and pozzolan test results must be within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

Calculations

SD-06 Test Reports

Concrete mix design; G

Fly ash

Pozzolan

Ground granulated blast-furnace slag

Aggregates

Tolerance report

Compressive strength tests

Unit weight of structural lightweight concrete

Ion concentration

Air Content

Slump

Air Entrainment

SD-07 Certificates

Material Safety Data Sheets

SD-08 Manufacturer's Instructions

Fly ash

Ground granulated blast-furnace slag

Submit mill certificates for Steel Bar according to the

paragraph entitled, "Fabrication," of this section.

Provide certificates for concrete that are in accordance with the paragraph entitled, "Classification and Quality of Concrete," of this section. Provide certificates that contain project name and number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results. Provide certificates for [Welder Qualifications](#) that are in accordance with the paragraph entitled, "Qualifications for Welding Work," of this section.

[Welding Procedures](#)

[SD-11 Closeout Submittals](#)

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. [ACI/MCP-2](#) for job site storage of materials. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

1.6 QUALITY ASSURANCE

1.6.1 Design Data

1.6.2 Drawings

1.6.2.1 [Reinforcing Steel](#)

[ACI/MCP-4](#). Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars.

1.6.3 Control Submittals

1.6.3.1 Curing Concrete Elements

Submit proposed materials and methods for curing concrete elements.

1.6.3.2 Pumping Concrete

Submit proposed materials and methods for pumping concrete. Submittal must include mix designs, pumping equipment including type of pump and size and material for pipe, and maximum length and height concrete is to be pumped.

1.6.3.3 VOC Content for form release agents, curing compounds, and concrete penetrating sealers

Submit certification for the form release agent, curing compounds, and concrete penetrating sealers that indicate the VOC content of each product.

1.6.3.4 Material Safety Data Sheets

Submit Material Safety Data Sheets (MSDS) for all materials that are regulated for hazardous health effects. Prominently post the MSDS at the construction site.

1.6.4 Test Reports

1.6.4.1 Concrete Mix Design

Submit copies of laboratory test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix must be suitable for the job conditions. Include mill test and all other test for cement, aggregates, and admixtures in the laboratory test reports. Provide maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Submit test reports along with the concrete mix design. Obtain approval before concrete placement.

1.6.4.2 Fly Ash and Pozzolan

Submit test results in accordance with [ASTM C 618](#) for fly ash and pozzolan. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on fly ash use in concrete.

1.6.4.3 Ground Granulated Blast-Furnace Slag

Submit test results in accordance with [ASTM C 989](#) for ground granulated blast-furnace slag. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on slag use in concrete.

1.6.4.4 Aggregates

[ASTM C 1260](#) for potential alkali-silica reactions, [ASTM C 295](#) for petrographic analysis.

1.6.5 Field Samples

1.6.5.1 Slab Finish Sample

Install minimum of 10 foot by 10 foot slab. Finish as required by specification.

1.7 QUALIFICATIONS FOR CONCRETE TESTING SERVICE

Perform concrete testing by an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency must meet the requirements of [ASTM E 329](#).

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor-Furnished Mix Design

[ACI/MCP-1](#), [ACI/MCP-2](#), and [ACI/MCP-3](#) except as otherwise specified. Indicate the compressive strength (f'c) of the concrete for each portion of the structure(s) and as specified below.

Location	f'c	ASTM C 33/C 33M		Water-Cement Ratio (by weight)	Maximum Air Entr. (percent)
	(Min. 28-Day Comp. Strength) (psi)	Maximum Nominal Aggregate (Size No.)	Range of Slump (inches)		
Concrete exposed to weather	4000	57	3-4	0.50	6
Floor slabs	3500	See Combined 3-4 Aggregate Gradation		0.45	3-5
All other areas	3500	57	3-4	0.45	3-5

Maximum slump shown above may be increased 1 inch for methods of consolidation other than vibration. Slump may be increased to 8 inches when superplasticizers are used. Provide air entrainment using air-entraining admixture. Provide air entrainment within plus or minus 1.5 percent of the value specified. The water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days must not exceed 0.15. Note (a): Entrapped air must be 3% or less.

Proportion concrete mixes for strength at 56 days.

2.1.1.1 Mix Proportions for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with [ASTM C 192/C 192M](#) and tested in accordance with [ASTM C 39/C 39M](#). Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project and must be accompanied by the manufacturer's or producer's test report indicating

compliance with these specifications. Base trial mixtures having proportions, consistencies, and air content suitable for the work on methodology described in [ACI/MCP-1](#). In the trial mixture, use at least three different water-cement ratios for each type of mixture, which must produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratio required must be based on equivalent water-cement ratio calculations as determined by the conversion from the weight ratio of water to cement plus pozzolan, and ground granulated blast-furnace slag by weight equivalency method. Design laboratory trial mixture for maximum permitted slump and air content. Each combination of material proposed for use must have separate trial mixture, except for accelerator or retarder use can be provided without separate trial mixture. Report the temperature of concrete in each trial batch. For each water-cement ratio, at least three test cylinders for each test age must be made and cured in accordance with [ASTM C 192/C 192M](#) and tested in accordance with [ASTM C 39/C 39M](#) for 7 and 28 days. From these results, plot a curve showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, plot a curve showing the relationship between 7 and 28 day strengths.

2.1.1.2 Required Average Strength of Mix Design

The selected mixture must produce an average compressive strength exceeding the specified strength by the amount indicated in [ACI/MCP-2](#). When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation must be calculated and the required average compressive strength must be determined in accordance with [ACI/MCP-2](#). When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength must follow [ACI/MCP-2](#) requirements.

2.1.2 Ready-Mix Concrete

Provide concrete that meets the requirements of [ASTM C 94/C 94M](#).

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by [ASTM C 94/C 94M](#):

Type and brand cement

Cement content in 95-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water/cement ratio

2.1.3 Concrete Curing Materials

2.1.3.1 Membrane-Forming Curing Compound

Provide liquid type compound conforming to [ASTM C 309](#), Type 1, clear, Type 1D with fugitive dye for interior work and Type 2, white, pigmented for exterior work.

2.2 MATERIALS

2.2.1 Cement

ASTM C 150, Type I or II or ASTM C 595, Type IP(MS) or IS(MS) blended cement except as modified herein. Provide blended cement that consists of a mixture of ASTM C 150, Type II, cement and one of the following materials: ASTM C 618 pozzolan or fly ash, ASTM C 989 ground granulated blast-furnace slag. For portland cement manufactured in a kiln fueled by hazardous waste, maintain a record of source for each batch. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

2.2.1.1 Fly Ash and Pozzolan

ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition must be 6 percent for Types N and F. Add with cement. Fly ash content must be a minimum of 35 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C 311. Evaluate and classify fly ash in accordance with ASTM D 5759.

High contents of supplementary cementitious materials can have some detrimental effects on the concrete properties, such as slowing excessively the strength gain rate, and delaying and increasing the difficulty of finishing. The recommended maximum content (by weight of the total cementitious material) for these materials are:

1. For GGBF slag: 50 percent
2. For fly ash or natural pozzolan: 40 percent (25 percent in cold climates)

2.2.1.2 Ground Granulated Blast-Furnace Slag

ASTM C 989, Grade 80. Slag content must be a minimum of 25 percent by weight of cementitious material.

2.2.1.3 Portland Cement

Provide cement that conforms to ASTM C 150, Type I, IA, II, or IIA. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

2.2.2 Water

Minimize the amount of water in the mix. The amount of water must not exceed 45 percent by weight of cementitious materials (cement + pozzolans), and in general, improve workability by adjusting the grading rather than by adding water. Water must be fresh, clean, and potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

2.2.3 Aggregates

ASTM C 33/C 33M, except as modified herein. Furnish aggregates for exposed

concrete surfaces from one source. Provide aggregates that do not contain any substance which may be deleteriously reactive with the alkalis in the cement.

Fine and coarse aggregates must show expansions less than 0.08 percent at 16 days after casting when testing in accordance with [ASTM C 1260](#). Should the test data indicate an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using [ASTM C 1567](#) using the Contractor's proposed mix design. In this case, include the mix design low alkali portland cement and one of the following supplementary cementitious materials:

1. GGBF slag at a minimum of 40 percent of total cementitious
2. Fly ash or natural pozzolan at a minimum of total cementitious of
 - a. 30 percent if $(SiO_2+Al_2O_3+Fe_2O_3)$ is 65 percent or more,
 - b. 25 percent if $(SiO_2+Al_2O_3+Fe_2O_3)$ is 70 percent or more,
 - c. 20 percent if $(SiO_2+Al_2O_3+Fe_2O_3)$ is 80 percent or more,
 - d. 15 percent if $(SiO_2+Al_2O_3+Fe_2O_3)$ is 90 percent or more.

If a combination of these materials is chosen, the minimum amount must be a linear combination of the minimum amounts above. Include these materials in sufficient proportion to show less than 0.08 percent expansion at 16 days after casting when tested in accordance with [ASTM C 1567](#).

Aggregates must not possess properties or constituents that are known to have specific unfavorable effects in concrete when tested in accordance with [ASTM C 295](#).

2.2.4 Nonshrink Grout

[ASTM C 1107/C 1107M](#).

2.2.5 Admixtures

[ASTM C 494/C 494M](#): Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures.

2.2.5.1 Air-Entraining

[ASTM C 260](#).

2.2.5.2 High Range Water Reducer (HRWR) (Superplasticizers)

[ASTM C 494/C 494M](#), Type F and [ASTM C 1017/C 1017M](#).

2.2.5.3 Pozzolan

Provide fly ash or other pozzolans used as admixtures that conform to [ASTM C 618](#).

2.2.6 Vapor Barrier

[ASTM D 4397](#) polyethylene sheeting, minimum 6 mil thickness.

Waterproof Paper. Kraft paper, glass reinforcing fibers and layers of polyethylene laminated under heat and pressure to form a single layer

meeting the requirements of [FS UU-B-790](#), Type I, Grade A, Style 4; or waterproof paper, regular, conforming to [ASTM C 171](#), consisting of two sheets of kraft paper cemented together with bituminous material in which are embedded cords or strands of fiber running in both directions not more than 1 1/4 inch apart.

2.2.6.1 Water-Vapor Barrier Subgrade Cover

Provide cover that is water-resistant barrier paper, uncreped and reinforced, conforming to [FS UU-B-790](#), Type I, Grade B, Style 4; or clear polyethylene sheeting, 6-mil, conforming to [ASTM D 2103](#) and [ASTM D 4397](#)

2.2.7 Materials for Curing Concrete

Use water-based curing compounds, sealers, and coatings with low (maximum 160 grams/liter, less water and less exempt compounds) zero VOC content.

Consider the use of water based or vegetable or soy based curing agents in lieu of petroleum based products. Consider agents that are not toxic and emit low or no Volatile Organic Compounds (VOC). Consider the use of admixtures that offer high performance to increase durability of the finish product but also have low toxicity and are made from bio-based materials such as soy, and emit low levels of Volatile Organic Compounds (VOC).

2.3 REINFORCEMENT

Fabricks and chairs.

2.3.1 Reinforcing Bars

[ACI/MCP-2](#) unless otherwise specified. Use deformed steel. [ASTM A 615/A 615M](#) and [AASHTO M 322M/M 322](#) with the bars marked A, S, W, Grade 60; or [ASTM A 996/A 996M](#) with the bars marked R, Grade 60, or marked A, Grade 60.

2.3.2 Wire

[ASTM A 82/A 82M](#) or [ASTM A 496/A 496M](#).

2.3.2.1 Welded Wire Fabric

[ASTM A 185/A 185M](#) or [ASTM A 497/A 497M](#). Provide flat sheets of welded wire fabric for slabs and toppings.

2.3.2.2 Steel Wire

Wire must conform to [ASTM A 82/A 82M](#).

2.3.3 Reinforcing Bar Supports

Provide bar ties and supports of coated or non corrodible material.

2.3.4 Supports for Reinforcement

Supports include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire fabric in place.

Provide wire bar type supports conforming to [ACI/MCP-3](#) and [CRSI 10MSP](#).

2.4 CLASSIFICATION AND QUALITY OF CONCRETE

2.4.1 Concrete Classes and Usage

Provide concrete classes, compressive strength, requirements for air entrainment, and usage as follows:

<u>CONCRETE CLASS</u>	<u>MIN. 28-DAY COMPRESSIVE STRENGTH POUNDS PER SQ. IN.</u>	<u>REQUIREMENT FOR AIR ENTRAINMENT</u>	<u>USAGE</u>
3A	3,000	Air-entrained	For foundation concrete work exposed to freezing and thawing or subjected to hydraulic pressure, such as foundation walls, grade beams, pits, tunnels. For exterior concrete slabs, such as steps, platforms, walks
3N	3,000	Nonair-entrained	For foundation concrete work not exposed to freezing and thawing or subjected to hydraulic pressure, such as footings, pile caps, foundation mats. For interior slabs on ground to be covered with resilient flooring
4N	4,000	Nonair-entrained	For structural concrete work not exposed to freezing and thawing such as interior columns, beams, supported slabs and other structural members for interior slabs on ground subjected to foot traffic

2.4.2 Limits for Concrete Proportions

Provide limits for maximum water/cement ratio and minimum cement content for each concrete class as follows:

<u>CONCRETE CLASS</u>	<u>MAX. WATER/CEMENT RATIO BY WEIGHT</u>	<u>MIN. CEMENT FOR 3- TO 4-INCH SLUMP, (NO. OF 94-POUND SACKS) PER CU. YD.</u>
3A	0.50	5.25

<u>CONCRETE CLASS</u>	<u>MAX. WATER/CEMENT RATIO BY WEIGHT</u>	<u>MIN. CEMENT FOR 3- TO 4-INCH SLUMP, (NO. OF 94- POUND SACKS) PER CU. YD.</u>
3N	0.54	5.25
4N	0.48	6.0

* Weight of water to weight of cement in pounds in one cubic yard of concrete

2.4.3 Maximum Size of Aggregate

Size of aggregate, designated by the sieve size on which maximum amount of retained coarse aggregate is 5 to 10 percent by weight, must be as follows:

<u>MAXIMUM SIZE OF AGGREGATE</u>	<u>ASTM C 33/C 33M SIZE NUMBER</u>	<u>TYPE OF CONSTRUCTION</u>
3/4 inch	67	Monolithic concrete slabs and other flatwork having a depth of not less than 2-1/2 inches and a clear distance between reinforcing bars of not less than 1 inch

Maximum size of aggregate may be that required for most critical type of construction using that concrete class.

Specify gradation of aggregates for separate floor topping.

2.4.4 Slump

Provide slump for concrete at time and in location of placement as follows:

<u>TYPE OF CONSTRUCTION</u>	<u>SLUMP</u>
Footings, unreinforced walls	Not less than 1 inch nor more than 3 inches
Columns, beams, reinforced walls, monolithic slabs	Not less than 1 inch nor more than 4 inches

2.4.5 Total Air Content

Air content of exposed concrete and interior concrete must be in accordance with ASTM C 260 and/or as follows:

<u>LIMITS</u> <u>CONCRETE</u> <u>EXPOSURE</u>	<u>REQUIREMENT</u> <u>FOR AIR</u> <u>ENTRAINMENT</u>	<u>MAXIMUM SIZE</u> <u>OF AGGREGATE</u>	<u>TOTAL AIR CONTENT</u> <u>BY VOLUME</u>
Exposed to freezing and thawing or subjected to hydraulic pressure	Air- entrained	1-1/2 or 2 inches 3/4 inch	4 to 6 percent 5 to 7 percent 6 to 8.5 percent

Provide concrete exposed to freezing and thawing or subjected to hydraulic pressure that is air-entrained by addition of approved air-entraining admixture to concrete mix.

PART 3 EXECUTION

3.1 EXAMINATION

Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.

If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before processing.

Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect/Engineer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

3.2.1 General

Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Foundations and Footings

When subgrade material is semiporous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited. When subgrade material is porous, seal subgrade surface by covering surface with specified water barrier subgrade cover; this may also be used over semiporous, dry subgrade material instead of water sprinkling.

3.2.3 Subgrade Under Slabs on Ground

Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

Previously constructed subgrade or fill must be cleaned of foreign materials and inspected by the Contractor for adequate compaction and

surface tolerances as specified.

Actual density of top 12 inches of subgrade soil material-in-place must not be less than the following percentages of maximum density of same soil material compacted at optimum moisture content in accordance with ASTM D 1557.

<u>SOIL MATERIAL</u>	<u>PERCENT MAXIMUM DENSITY</u>
Drainage fill	100
Cohesionless soil material	100
Cohesive soil material	95

Finish surface of drainage fill under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

Cover drainage fill surface under interior slabs on ground with specified water-vapor barrier subgrade cover immediately prior to placing reinforcement. Install subgrade cover to avoid puncture or tear. Patch punctures or tears over 12 inches with separate sheets lapped not less than 6 inches. Seal all punctures or tears less than 12 inches with pressure-sensitive vapor barrier tape not less than 2-inches wide. Seal lapped joints with vapor barrier adhesive or pressure-sensitive vapor barrier tape not less than 2-inches wide. Lay subgrade cover sheets with not less than a 6-inch lap at edges and ends and in direction in which concrete is to be placed.

Prepare subgrade or fill surface under exterior slabs on ground as specified for subgrade under foundations and footings.

3.2.4 Reinforcement and Other Embedded Items

Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

3.3 FORMS

3.3.1 General

Construct forms to conform, within the tolerances specified, to shapes dimensions, lines, elevations, and positions of cast-in-place concrete members as indicated. Forms must be supported, braced, and maintained sufficiently rigid to prevent deformation under load.

3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI/MCP-2. Provide bars, wire fabric, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3.4.1 General

Provide details of reinforcement that are in accordance with, and [ACI/MCP-4](#) and as specified.

3.4.2 Vapor Barrier

Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of **12 inches** and tape or cement joints. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement must not damage vapor barrier material. Place a **2 inch** layer of clean concrete sand on vapor barrier before placing concrete.

3.4.3 Reinforcement Supports

Place reinforcement and secure with galvanized or non corrodible chairs, spacers, or metal hangers. For supporting reinforcement on the ground, use concrete or other non corrodible material, having a compressive strength equal to or greater than the concrete being placed.

3.4.4 Splicing

As indicated. For splices not indicated [ACI/MCP-2](#). Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus **2 inches**.

3.4.5 Cover

[ACI/MCP-2](#) for minimum coverage, unless otherwise indicated.

3.4.6 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.4.7 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

3.4.8 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

Provide fabrication tolerances that are in accordance with [ACI/MCP-1](#), [ACI/MCP-2](#) and [ACI/MCP-3](#).

Provide hooks and bends that are in accordance with and [ACI/MCP-3](#).

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Tolerance on nominally square-cut, reinforcing bar ends must be in accordance with [ACI/MCP-3](#).

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.4.9 Placing Reinforcement

Place reinforcement in accordance with [ACI/MCP-4](#).

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire fabric on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Contractor must cooperate with other trades in setting of anchor bolts, inserts, and other embedded items. Where conflicts occur between locating reinforcing and embedded items, the Contractor must notify the Contracting Officer so that conflicts may be reconciled before placing concrete. Anchors and embedded items must be positioned and supported with appropriate accessories.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

Provide supports for reinforcing bars that are sufficient in number and sufficiently heavy to carry the reinforcement they support, and in accordance with [ACI/MCP-4](#) and [CRSI 10MSP](#). Do not use supports to support runways for concrete conveying equipment and similar construction loads.

Equip supports on ground and similar surfaces with sand-plates.

Support welded wire fabric as required for reinforcing bars.

Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

With the exception of temperature reinforcement, tied to main steel approximately 24 inches on center, reinforcement must be accurately placed, securely tied at intersections with 18-gage annealed wire, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form.

Unless otherwise indicated, numbers, type, and spacing of supports must conform to [ACI/MCP-3](#).

Bending of reinforcing bars partially embedded in concrete is permitted only as specified in [and ACI/MCP-4](#).

3.4.10 Spacing of Reinforcing Bars

Spacing must be as indicated. If not indicated, spacing must be in accordance with the [ACI/MCP-3](#).

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to approval.

3.5 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

[ASTM C 94/C 94M](#), and [ACI/MCP-2](#), except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.5.1 Measuring

Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."

3.5.2 Mixing

[ASTM C 94/C 94M](#) and [ACI/MCP-2](#). Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

3.5.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.6 PLACING CONCRETE

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing

concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other. Position grade stakes on 10 foot centers maximum in each direction when pouring interior slabs and on 20 foot centers maximum for exterior slabs.

3.6.1 General Placing Requirements

Deposit concrete continuously or in layers of such thickness that no concrete is placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation.

Concrete to receive other construction must be screeded to proper level to avoid excessive skimming or grouting.

Do not use concrete which becomes nonplastic and unworkable or does not meet quality control limits as specified or has been contaminated by foreign materials. Use of retempered concrete is permitted. Remove rejected concrete from the site.

3.6.2 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

3.6.3 Vibration

ACI/MCP-2. Furnish a spare, working, vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate internal vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 20 inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required.

3.6.4 Pumping

ACI/MCP-2. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

3.6.5 Cold Weather

ACI/MCP-2. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

3.6.6 Hot Weather

Maintain required concrete temperature using Figure 2.1.5 in **ACI/MCP-2** to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.6.7 Follow-up

Check concrete within 24 hours of placement for flatness, levelness, and other specified tolerances. Adjust formwork and placement techniques on subsequent pours to achieve specified tolerances.

3.6.8 Placing Concrete Slabs

Place and consolidate concrete for slabs in a continuous operation, within the limits of approved construction joints until placing of panel or section is completed.

During concrete placing operations, consolidate concrete by mechanical vibrating equipment so that concrete is worked around reinforcement and other embedded items and into corners. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground by mechanical vibrators as specified. Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other approved method. Limit consolidation operations to time necessary to obtain consolidation of concrete without bringing an excess of fine aggregate to the surface. Concrete to be consolidated must be as dry as practical and surfaces thereof must not be manipulated prior to finishing operations. Bring concrete correct level with a straightedge and struck-off. Use bull floats or darbies to smooth surface, leaving it free of humps or hollows. Sprinkling of water on plastic surface is not permitted.

Provide finish of slabs as specified.

3.7 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI/MCP-2, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Where straightedge measurements are specified, Contractor must provide straightedge.

3.7.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.7.1.1 Steel Troweled

Use for floors intended as walking surfaces, and for reception of floor coverings. First, provide a floated finish. Next, the finish must be power troweled three times, and finally hand troweled. The first troweling after floating needs to produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Perform additional trowelings done by hand after the surface has hardened sufficiently. The final troweling is done when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate the surface by the hand troweling operations. The finished surface must be essentially free of trowel marks and uniform in texture and appearance. The finished surface must produce a surface level to within 1/4 inch in 10 feet. On surfaces intended to support floor coverings, remove any defects of sufficient magnitude to show through the floor covering by grinding.

3.7.1.2 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Perform a floated finish, then draw a broom or burlap belt across the surface to produce a coarse scored texture. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

3.7.1.3 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. a burlap drag. Drag a strip of clean, wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8 inch.

3.7.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where

sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.7.3 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be 24 inches long, 12 inches wide, and 4 inches thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

3.8 CURING AND PROTECTION

3.8.1 General

Protect freshly placed concrete from premature drying and cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of cement and proper hardening of concrete.

Start initial curing as soon as free water has disappeared from surface of concrete after placing and finishing. Keep concrete moist for minimum 72 hours.

Final curing must immediately follow initial curing and before concrete has dried. Continue final curing until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with the concrete is above 50 degrees F has totaled 168 hours. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, final curing may be terminated when the average compressive strength has reached 70 percent of the 28-day design compressive strength. Prevent rapid drying at end of final curing period.

3.8.2 Liquid Membrane-Forming Curing Compound

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Apply in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI/MCP-2 indicates that hot weather conditions cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

3.8.2.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats must be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound must form a uniform, continuous, coherent film that does not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Re-spray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

3.8.3 Curing Periods

ACI/MCP-2 except 10 days for retaining walls, pavement or chimneys, 21 days for concrete that is in full-time or intermittent contact with seawater, salt spray, alkali soil or waters. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.8.4 Curing Unformed Surfaces

Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

Unless otherwise specified, accomplish final curing of unformed surfaces by any of curing methods specified above, as applicable.

Accomplish final curing of concrete surfaces to receive liquid floor hardener or finish flooring by moisture-retaining cover curing.

3.8.5 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

3.8.6 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.8.7 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.9 FIELD QUALITY CONTROL

3.9.1 Sampling

ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31/C 31M for making test specimens.

3.9.2 Testing

3.9.2.1 Slump Tests

ASTM C 143/C 143M. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

3.9.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.9.2.3 Compressive Strength Tests

ASTM C 39/C 39M. Make five test cylinders for each set of tests in accordance with **ASTM C 31/C 31M.** Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Take samples for strength tests of each mix design of concrete placed each day not less than once a day, nor less than once for each 160 cubic yards of concrete, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'c or if any strength test result falls below f'c by more than 450 psi, take a minimum of three **ASTM C 42/C 42M** core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test is considered structurally adequate if the average of three cores is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. Retest locations represented by erratic core strengths. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.9.2.4 Air Content

ASTM C 173/C 173M or **ASTM C 231** for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

3.9.2.5 Strength of Concrete Structure

Compliance with the following is considered deficient if it fails to meet the requirements which control strength of structure in place, including following conditions:

Failure to meet compressive strength tests as evaluated

Reinforcement not conforming to requirements specified

Concrete which differs from required dimensions or location in such a manner as to reduce strength

Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified

Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration

Poor workmanship likely to result in deficient strength

3.9.2.6 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements, make cores drilled from hardened concrete for compressive strength determination in accordance with [ASTM C 42/C 42M](#), and as follows:

Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

Test cores after moisture conditioning in accordance with [ASTM C 42/C 42M](#) if concrete they represent is more than superficially wet under service.

Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Core specimens will be taken and tested by the Government. If the results of core-boring tests indicate that the concrete as placed does not conform to the drawings and specification, the cost of such tests and restoration required must be borne by the Contractor.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

3.10 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows.

3.10.1 Mixing Equipment

Before concrete pours, designate Company-owned site meeting environmental standards for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.10.2 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.10.3 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material.

3.11 JOINTS

3.11.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Locate construction joints as follows:

- a. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

Joints must be perpendicular to main reinforcement. Reinforcement must be continued across construction joints.

3.11.2 Control Joints in Slabs on Ground

Under and on exact line of each control joint, cut 50 percent of welded wire fabric reinforcement before placing concrete.

Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface or by cutting the concrete with a saw after the concrete has set. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.

3.11.3 Sealing Joints in Slabs on Ground

Sealing is not required for isolation and control joints to be covered with finish flooring material. Groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.12 INSTALLATION OF ANCHORAGE DEVICES

3.12.1 General

Anchorage devices and embedded items required for other work that is attached to, or supported by, set and build in cast-in-place concrete as part of the work of this section, using setting drawings, instructions, and directions for work to be attached thereto.

3.12.2 Placing Anchorage Devices

Anchorage devices and embedded items must be positioned accurately and supported against displacement. Fill openings in anchorage devices such as slots and threaded holes with an approved, removable material to prevent entry of concrete into openings.

3.13 CONCRETE CONVEYING

3.13.1 Transfer of Concrete At Project Site

Handle concrete from point of delivery and transfer to concrete conveying equipment and to locations of final deposit as rapidly as practical by methods which prevent segregation and loss of concrete mix materials.

3.13.2 Mechanical Equipment for Conveying Concrete

Equipment must ensure a continuous flow of concrete at delivery end, as approved. Provide runways for wheeled concrete-conveying equipment from concrete delivery point to locations of final deposit. Interior surfaces of concrete conveying equipment must be free of hardened concrete, debris, water, snow, ice, and other deleterious substances.

-- End of Section --

SECTION 28 31 76

INTERIOR FIRE ALARM SYSTEM
11/08

PART 1 GENERAL

1.1 RELATED SECTIONS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein. In addition, refer to the following sections for related work and coordination:

Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

1.2 REFERENCES

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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2 (1989; R 1999) Method for Measuring the Intelligibility of Speech Over Communication Systems (ASA 85)

FM GLOBAL (FM)

FM P7825a (2005) Approval Guide Fire Protection

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002) IEEE Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.41.2 (2002) IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16 (2003) Sound System Equipment - Part 16: Objective Rating Of Speech Intelligibility By Speech Transmission Index

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 7240-16 (2007) Fire Detection And Alarm Systems - Part 16: Sound System Control And Indicating Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2006) Life Safety Code, 2006 Edition

NFPA 170	(2009) Fire Safety Symbols
NFPA 241	(2009) Safeguarding Construction, Alteration, and Demolition Operations
NFPA 70	(2007; AMD 1 2008) National Electrical Code - 2008 Edition
NFPA 72	(2007) National Fire Alarm Code
NFPA 90A	(2008) Standard for the Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1638	(2001; Rev thru Oct 2008) Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling
UL 1971	(2002; Rev thru Oct 2008) Signaling Devices for the Hearing Impaired
UL 2017	(2008) Standard for Safety for General-Purpose Signaling Devices and Systems
UL 268	(2006) Standard for Smoke Detectors for Fire Alarm Signaling Systems
UL 268A	(2008) Smoke Detectors for Duct Application
UL 464	(2003; Rev thru Feb 2008) Standard for Audible Signal Appliances
UL 864	(2003; Rev thru May 2007) Control Units and Accessories for Fire Alarm Systems
UL Electrical Constructn	(2008) Electrical Construction Equipment Directory
UL Fire Prot Dir	(2009) Fire Protection Equipment Directory

1.3 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

- a. Analog/Addressable System: A system where multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.
- b. Hard Wired System: A system where alarm and supervisory initiating devices are directly connected, through individual dedicated conductors, to a central control panel without the use of analog/addressable circuits or devices.
- c. Interface Device: An addressable device that interconnects hard

wired systems or devices to an analog/addressable system.

d. Remote Fire Alarm Control Unit: A control panel, electronically remote from the fire alarm control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.

e. Fire Alarm Control Panel (FACP): A master control panel having the features of a fire alarm control unit and fire alarm control units are interconnected. The panel has central processing, memory, input and output terminals.

f. Terminal Cabinet: A steel cabinet with locking, hinge-mounted door that terminal strips are securely mounted.

1.4 SYSTEM DESCRIPTION

1.4.1 Scope

a. This work includes completion of design and modifying the existing analog/addressable fire alarm system as described herein and on the contract drawings for the [New River Child Development Center, Building AS1000](#). Include in the system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide system complete and ready for operation.

b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with the required and advisory provisions of [NFPA 72](#), [ISO 7240-16](#), [IEC 60268-16](#), except as modified herein. The system layouts on the drawings show the intent of coverage and are shown in suggested locations. Final quantity, [system layout](#), and coordination are the responsibility of the Contractor.

1.4.2 [Technical Data and Computer Software](#)

Technical data and computer software (meaning technical data that relates to computer software) that are specifically identified in this project, and may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES. Identify data delivered by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable

portions of the fire alarm and detection system.

- d. Description of [Fire Alarm Control Panel](#) equipment operation.
- e. Description of auxiliary and remote equipment operations.
- f. Library of application software.
- g. Operation and maintenance manuals.

1.4.3 Keys

Keys and locks for equipment shall be identical. Provide not less than six keys of each type required. All keys and locks shall be mastered to a single key as required by the local AHJ.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section [01 33 00](#)
SUBMITTAL PROCEDURES:

[SD-02 Shop Drawings](#)

Annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ISO A1.

[Wiring Diagrams; G](#)

Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

[System Layout; G](#)

Plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of [NFPA 170](#), Fire Safety Symbols.

[System Operation; G](#)

A complete list of device addresses and corresponding messages.

[Notification Appliances; G](#)

Data on each circuit to indicate that there is at least 25

percent spare capacity for notification appliances, 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.

As-Built Drawings

Six sets of detailed as-built drawings. Furnish one set of full size paper as-built drawings and schematics. The drawings shall be prepared on uniform sized mylar sheets not less than 30 by 42 inches with 8 by 4 inch title block similar to contract drawings. Furnish one set of CD or DVD discs containing software back-up and CAD based drawings in latest version of AutoCadd and DXF format of as-built drawings and schematics. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings shall be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

SD-03 Product Data

UL or FM listing cards for equipment provided.

Technical Data And Computer Software; G
Fire alarm control panel (FACP); G
Terminal cabinets/assemblies; G
Manual stations; G
Batteries; G
Battery chargers; G
Smoke sensors; G
Wiring and cable; G
Notification appliances; G
Addressable interface devices
Tamper switches; G

SD-05 Design Data

System Operation; G

A complete description of the system operation in matrix format on the drawings.

Battery power; G

Battery calculations as required in paragraph Battery Power Calculations.

SD-06 Test Reports

Field Quality Control
Testing Procedures; G
Smoke sensor testing procedures; G

SD-07 Certificates

Installer

SD-09 Manufacturer's Field Reports

Fire Alarm System

A unique identifier for each device, including the control panel and initiating and indicating devices, with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information. Include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports.

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G

Six copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training.

Original and backup copies of all software delivered for this project, on each type of CD/DVD media utilized.

Instruction of Government Employees

The installers training history for the employees involved with this contract.

1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system. The fire alarm control panel is a Simplex 4005 with a Simplex 4009 power extender panel next to the FACP in the main entrance/lobby area. Both panels are recessed in CMU block wall. These panels will remain and shall operate as presently programmed.

The fire alarm transmitter is a Seaboard Systems, Transmitter/Junction Unit, Model TX-1/LC. The existing appliance will remain and shall operate as presently programmed.

- a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Naval Facilities Engineering Command, NAVFAC Midlant, Fire Protection Engineer.
- b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.
- c. Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM P7825a.

1.6.1 Qualifications

1.6.1.1 Design Services

Installations requiring completion of installation drawings and specification or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified engineer. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

- a. A registered professional engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of four years work experience in fire protection engineering.
- b. A registered professional engineer (P.E.) in fire protection engineering.

1.6.1.2 Supervisor

The installing Contractor shall provide the following: The Fire Alarm technicians supervising the installation of equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.6.1.3 Technician

The installing Contractor shall provide the following: Fire Alarm Technicians with a minimum of four years of experience utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.6.1.4 Installer

The installing Contractor shall provide the following: Fire Alarm installer with a minimum of two years of experience utilized to assist in the installation of fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system. The Fire Alarm installer shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.6.1.5 Test Personnel

The installing Contractor shall provide the following: Fire Alarm Technicians with a minimum of eight years of experience utilized to test and certify the installation of the fire alarm devices, cabinets and panels. The Fire Alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.6.1.6 Manufacturer's Representative

The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel. The Manufacturer's Representative shall be an employee of the manufacturer with necessary

technical training on the system being installed.

1.6.1.7 Manufacturer

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

1.6.2 Regulatory Requirements

1.6.2.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM P7825a. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM P7825a. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

1.6.2.2 Testing Services or Laboratories

Fire alarm and fire detection equipment shall be constructed in accordance with UL Fire Prot Dir, UL Electrical Constructn, or FM P7825a.

1.7 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The Interior Fire Alarm System Operation and Maintenance Instructions shall include:

- a. "Manufacturer Data Package 5" as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.
- b. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features.
- c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
- d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.
- e. Software delivered for this project shall be provided, on each type of CD/DVD media utilized.
- f. Printouts of configuration settings for all devices.
- g. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list

all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

1.9 EXTRA MATERIALS

1.9.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site.

1.9.2 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

1.9.3 Spare Parts

Furnish the following spare parts and accessories:

- a. One Manual Fire Alarm Box
- b. One Smoke Detector
- c. One Strobe-only (110cd) Notification Device

1.9.4 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least two years prior to bid opening.

2.1.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract

number provided on a new plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

- a. FACPs
- b. Automatic transmitter

Furnish nameplates to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.2 GENERAL PRODUCT REQUIREMENT

All fire alarm equipment shall be listed for use under the applicable reference standards. Interfacing of Listed [UL 864](#) or similar approved industry listing with [Fire Alarm Panels](#) listed to [UL 2017](#) or equal shall be done in a laboratory listed configuration, if the software programming features can not provide a listed interface control. If a field modification is needed, such as adding equipment like relays, the manufacturer of the panels being same or different brand from manufacturer shall provide the installing contractor for review and confirmation by the installing contractor. The installing contractor shall, as part of the submittal documents, provide this information.

2.3 SYSTEM OPERATION

The Addressable Interior Fire Alarm System shall be a complete, supervised, noncoded, analog/addressable fire alarm system conforming to [NFPA 72](#), [UL 864](#) Ninth Edition, and [UL 2017](#). The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. The system may be placed in the alert mode by local microphones or remotely from authorized locations/users.

2.3.1 Alarm Initiating Devices

Connect alarm initiating devices to initiating device circuits (IDC), [Class B](#), to signal line circuits (SLC), and install in accordance with [NFPA 72](#).

- a. Alarm notification appliances shall be connected to notification appliance circuits (NAC) in accordance with [NFPA 72](#). [The notification appliance circuit shall be extended, and wiring methods shall match the existing conditions.](#)
- b. Any single impairment of the system shall not affect the system on more than one-half of any floor.
- c. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Audible, and visual appliances and systems shall comply with [NFPA 72](#). Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc.

2.3.2 Functions and Operating Features

The system shall provide the following functions and operating features:

- a. The FACP/FMCP and fire alarm control units, if used, shall provide power, annunciation, supervision, and control for the system. Addressable systems shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits with sufficient memory to perform as specified.
- b. Provide Class B initiating device circuits for conductor lengths of 10 feet or less.
- c. Provide Class B, Style 4 signaling line circuits for the network.
- d. Provide Class B notification appliance circuits. The visual alarm notification appliances shall have the flash rates synchronized.
- e. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
- f. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault. The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature that shall silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.
- g. Provide a notification appliance silencing switch, that when activated, will silence the audible signal appliance, but will not affect the visual alarm indicator, the liquid crystal display, or the automatic notification of the fire department. This switch shall be overridden upon activation of a subsequent alarm.
- h. Provide alarm verification capability for smoke sensors. Alarm verification shall initially be set for 30 seconds.
- i. Provide program capability via switches in a locked portion of the FACP to bypass the automatic notification appliance circuits, fire reporting system and air handler shutdown features. Operation of this programming shall indicate this action on the FACP display and printer output.
- j. Alarm, supervisory, and/or trouble signals shall be automatically transmitted to the fire department.
- k. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
- l. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

m. There shall be no limit, other than maximum system capacity, as to the number of addressable devices, that may be in alarm simultaneously.

n. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as an HVAC system, the addressable fire alarm relay shall be within 3 feet of the emergency control device.

o. An alarm signal shall automatically initiate the following functions:

(1) Transmission of an alarm signal to the fire department.

(2) Visual indication of the device operated on the fire alarm control panel (FACP).

(3) Continuous actuation of all alarm notification appliances.

(4) Recording of the event electronically in the history log of the fire control system unit.

(5) Operation of a duct smoke sensor shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.

(6) Operation of an interface, that operates vibrating pagers worn by hearing-impaired occupants.

p. A supervisory signal shall automatically initiate the following functions:

(1) Visual indication of the device operated on the FACP and sound the audible alarm at the respective panel.

(2) Recording of the event electronically in the history log of the fire control system unit.

q. A trouble condition shall automatically initiate the following functions:

(1) Visual indication of the system trouble on the FACP and sound the audible alarm at the respective panel.

(2) Recording of the event electronically in the history log of the fire control system unit.

r. The maximum permissible elapsed time between the actuation of an initiating device and its indication at the FACP shall be 10 seconds.

s. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP shall not exceed 200 seconds.

2.4 SYSTEM MONITORING

2.4.1 Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, isolating valves

for pressure type waterflow or supervision switches, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Each tamper switch shall be provided with a separate address, unless they are within the same room, then a maximum of five can use the same address.

2.4.2 Independent Fire Detection System

Each existing independent smoke detection subsystem, and kitchen fire extinguishing system shall be monitored both for the presence of an alarm condition and for a trouble condition. Each monitored condition shall be provided with a separate address.

2.5 OVERVOLTAGE AND SURGE PROTECTION

2.5.1 Signaling Line Circuit Surge Protection

For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of [IEEE C62.41.1](#) and [IEEE C62.41.2](#). Cables and conductors, that serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform(s):

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

2.5.2 Sensor Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveforms:

- a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

2.6 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored shall be configured as a [Class B](#), Style B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc. The module shall be UL or FM listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall

contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED. Existing fire alarm system initiating device circuits shall be connected to a single module to power and supervise the circuit.

2.7 ADDRESSABLE CONTROL MODULE

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed.

2.8 ISOLATION MODULES

Provide isolation modules to subdivide each signaling line circuit into groups of not more than 20 addressable devices between adjacent isolation modules.

2.9 SMOKE SENSORS

2.9.1 Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

- a. Provide analog/addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation in accordance with [UL 268](#). Smoke sensors shall be listed for use with the fire alarm control panel.
- b. Provide self-restoring type sensors that do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.
- c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.
- d. Provide twist lock bases for the sensors. The sensors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.
- e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors shall be of

the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

- (1) Primary status
- (2) Device type
- (3) Present average value
- (4) Present sensitivity selected
- (5) Sensor range (normal, dirty, etc.)

2.9.2 Duct Smoke Sensors

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated and in accordance with [NFPA 90A](#). Units shall consist of a smoke detector as specified in paragraph Photoelectric Detectors, mounted in a special housing fitted with duct sampling tubes. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detectors shall have a manual reset. Detectors shall be rated for air velocities that include air flows between [500 and 4000 fpm](#). Detectors shall be powered from the fire alarm panel.

a. Sampling tubes shall run the full width of the duct. The duct detector package shall conform to the requirements of [NFPA 90A](#), [UL 268A](#), and shall be UL listed for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the fire alarm control panel.

b. Lights to indicate the operation and alarm condition; and the test and reset buttons shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above [6 feet](#) and those mounted below [6 feet](#) that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test and reset switches.

c. Remote lamps and switches as well as the affected fan units shall be properly identified in etched plastic placards. Detectors shall provide for control of auxiliary contacts that provide control, interlock, and shutdown functions specified in Section [23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC](#). Auxiliary contacts provide for this function shall be located within [3 feet](#) of the controlled circuit or appliance. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.9.3 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with [NFPA 72](#) and manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval.

2.10 ELECTRIC POWER

2.10.1 Primary Power

Power shall be 120 VAC service for the NAC power supplies from the normal AC service to the building.

2.10.2 Generator

Where any emergency generator provides a standby power supply for life safety system circuits, provide a connection from one of the circuits for the fire alarm system.

2.11 EMERGENCY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

2.11.1 Batteries

Provide sealed, maintenance-free, sealed lead acid batteries as the source for emergency power to the FACP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.11.1.1 Capacity

Provide the batteries with sufficient capacity to operate the system under supervisory and trouble conditions, including audible trouble signal devices for 4 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes.

2.11.1.2 Battery Power Calculations

a. Verify that battery capacity exceeds supervisory and alarm power requirements.

1) Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component and each panel component, and the battery-recharging period shall be included.

2) Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.

3) A voltage drop calculation to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

b. For battery calculations use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby

time, and then calculate the required Amp-Hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period. Using this voltage perform a voltage drop calculation for circuit containing device and/or appliances remote from the power sources.

2.11.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (18 Volts dc), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours. Provide 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.

2.12 MANUAL STATIONS

Provide metal or plastic, semi-flush mounted, double action, addressable manual stations, that are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station. Manual stations shall be mounted at 48 inches. Stations shall have a separate screw terminal for each conductor.

2.13 NOTIFICATION APPLIANCES

2.13.1 Fire Alarm Audible Appliances

Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Audible appliances shall generate a unique audible sound from other devices provided in the building and surrounding area. Surface mounted audible appliances shall be painted red. Recessed audible appliances shall be installed with a grill that is painted red.

- a. Provide appliance mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.

2.13.2 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Americans With Disabilities Act (ADA). Colored lens such as amber, the notifications appliances shall comply with UL 1638. The manufacturer shall have the color lens tests to the full UL 1971 polar plotting criteria, voltage drop, and temperature rise as stated in 1971. Fire Alarm Notification Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light and be marked "Fire" in red letters. The light pattern shall be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate shall be 1 flash per second and a minimum of 15 candela (actual output after derating for tinted lens) based

on the UL 1971 test. Strobe shall be semi-flush mounted. Where more than two appliances are located in the same room or corridor, provide synchronized operation.

2.13.3 Chimes

Chimes shall be electrically operated, supervised, electronic type, with an adjustable frequency of 800 to 1200 Hertz. Chimes shall have a minimum sound rating of 80 dBA at 10 feet. Chimes shall ring the bell codes, as indicated.

2.13.4 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

2.14 ENVIRONMENTAL ENCLOSURES OR GUARDS

Environmental enclosures shall be provided to permit Fire Alarm components to be used in areas that exceed the environmental limits of the listing. The enclosure shall be listed for the device or appliance as either a manufactured part number or as a listed compatible accessory for the UL category that the component is currently listed. Guards required to deter mechanical damage shall be either a listed manufactured part or a listed accessory for the category of the initiating device or notification appliance.

2.15 VALVE MONITOR SWITCHES (TAMPER SWITCHES)

Provide a tamper switch for each fire protection system control valve. Tamper switches shall be UL listed as "Extinguishing System Attachment" for the location and type of valve supervised. The device shall contain double pole, double throw contacts. Operation of the switch shall cause a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Tamper switches shall be equipped with screw terminals for each conductor.

2.16 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.16.1 Alarm Wiring

The SLC wiring shall be copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 14 AWG size conductors at a minimum. Notification appliance circuit conductors, that contain audible alarm devices shall be solid copper No. 14 AWG size conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation.

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE ALARM INITIATING AND INDICATING DEVICES

a. FACP: The FACP is located in the main building lobby. New conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the FACP.

b. Manual Stations: Locate manual stations as required by NFPA 101 IEC 60268, Part 16, and ASA S3.2 and NFPA 72 and where shown on the drawings. Mount stations so that their operating handles are 4 feet above the finished floor. Mount stations so they are located no farther than 5 feet from the exit door they serve, measured horizontally.

c. Notification Appliance Devices: Locate notification appliance devices as required by NFPA 72 and where shown on the drawings. Mount assemblies on walls 90 inches above the finished floor or 6 inches below the ceiling whichever is lower. Ceiling mounted speakers shall conform to NFPA 72.

d. Smoke Sensors: Locate sensors as required by NFPA 72 and their listings and as shown on the drawings on a 4 inch mounting box. Sensors located on the ceiling shall be installed not less than 4 inches from a side wall to the near edge. Those located on the wall shall have the top of the sensor at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. In raised floor spaces, the smoke sensors shall be installed to protect 225 square feet per sensor. Install smoke sensors no closer than 5 feet from air handling supply outlets.

e. Water Tamper Switches: Locate tamper switches at each new, supervised sprinkler valve station.

f. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.

3.2 SYSTEM FIELD WIRING

3.2.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, that are securely mounted. The use of wire nuts or similar devices shall be prohibited. Wiring shall conform to NFPA 70.

3.2.2 Terminal Cabinets

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size shall be appropriate for the size of the wiring to be connected. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently

mounted in the terminal cabinet. Minimum size is 8 inches by 8 inches.

3.2.3 Alarm Wiring

Provide all wiring in rigid metal conduit or intermediate metal conduit. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FACP. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

3.2.4 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACP, and fire alarm control unit shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.3 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

3.4 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes, conduit and surface metal raceways red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD QUALITY CONTROL

3.5.1 Testing Procedures

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard

equipment, emergency communication equipment, interface equipment, Guard's Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

- a. Identify the NFPA Class and Style of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), and Signaling Line Circuits (SLC).
- b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.
- c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
- d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
- e. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.5.2 Tests Stages

- a. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- b. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Naval Facilities Engineering Command, NAVFAC Midlant, Fire Protection Engineer.
- c. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are provided at the job site:

- (1) The systems manufacturer's technical representative

- (2) Marked-up red line drawings of the system as actually installed
- (3) Megger test results
- (4) Loop resistance test results
- (5) Complete program printout including input/output addresses

The final tests shall be witnessed by the Naval Facilities Engineering Command, NAVFAC Midlant, Fire Protection Engineer. At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance. In existing buildings, the transfer of devices from the existing system to the new system and the permission to begin demolition of the old fire alarm system will not be permitted until the as-built drawings and O&M manuals are received.

3.5.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, ISO 7240-16, IEC 60268-16. The required tests are as follows:

- a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- b. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- c. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
- d. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- e. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.
- f. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- g. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

- h. Determine that the system is operable under trouble conditions as specified.
- i. Visually inspect wiring.
- j. Test the battery charger and batteries.
- k. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.
- l. Verify that red-line drawings are accurate.
- m. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- o. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.
- p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.
- q. Opening the circuit at not less than 10% of alarm initiating devices and notification appliances to test the wiring supervisory feature.
- r. Demonstrate modem communications with remote sites as specified by the COR. Dial in capability shall also, be demonstrated, using specified security.

3.6 INSTRUCTION OF GOVERNMENT EMPLOYEES

Equipment manufacturer shall provide 1 day on site and 5 days of technical training to the Government at the manufacturing facility. Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. Room and board costs shall be included for two Government personnel. Factory training shall occur within 6 months of system acceptance.

3.6.1 Instructor

Include in the project the services of an instructor, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

3.6.2 Required Instruction Time

Provide 8 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and

times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

3.6.3 Technical Data and Computer Software

Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize designated government personnel with proper operation of the installed system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

-- End of Section --

CODE ANALYSIS AND FIRE PROTECTION ANALYSIS

NEW RIVER CHILD DEVELOPMENT CENTER ADDITION, BUILDING AS-1000

MARINE CORPS BASE CAMP LEJEUNE

CAMP LEJEUNE, NC

June 24, 2009

(Revision 1, September 02, 2009)

Prepared by

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MCB Camp LeJeune

New River Child Development Center Addition, Building AS-1000

Code Analysis and Fire Protection Analysis

Applicable Codes and Standards (partial list)

- Unified Facilities Criteria (UFC) 3-600-01, Fire Protection Engineering for Facilities, 26 September 2006
- Unified Facilities Criteria (UFC) 3-600-10N, Fire Protection Engineering, final draft August 2007
- Unified Facilities Criteria (UFC) 1-200-01, General Building Requirements, 27 November 2007
- Unified Facilities Criteria (UFC) 4-010-01, DoD Minimum Antiterrorism Standard for Bldgs., 9 April 2008
- Unified Facilities Criteria (UFC) 4-021-0, Design O&M: Mass Notification Systems, 9 April 2008
- Unified Facilities Criteria (UFC) 4-740-14, Design: Child Development Centers, 1 August 2002
- International Building Code (IBC), 2006 Edition - as modified by UFC 1-200-01
- National Fire Protection Association (NFPA) 10, Portable Fire Extinguishers, 2002 Edition
- National Fire Protection Association (NFPA) 13, Installation of Sprinkler Systems, 2002 Edition
- National Fire Protection Association (NFPA) 101, Life Safety Code, 2006 Edition
- All NFPA Documents, except NFPA 5000, in effect at the time of the latest version of UFC 3-600-01 at notice to proceed date except those editions modified in UFC 1-200-01, Appendix A
- UFAS and ADAAG criteria (Uniform Federal Accessibility Standards).

The scope of this project includes the following:

- life safety analysis of the building due to the impact of additions to each end of the existing facility,
- extension of the existing fire alarm system to new addition spaces, and
- extension of the existing automatic, wet-pipe fire sprinkler system to new addition spaces.

Life Safety Analysis

Occupancy Classification: Group E (Education) (IBC Section, 308.5.2, Exception);
Existing Day-Care (NFPA 101, Section 17)

Construction Type: Type IIB

Building	Allowable Area (SF)	Actual Area (SF)	Allowable Height	Actual Height
CDC AS-1000	68,875	24,964	3 stories, 75 ft.	1 stories, 20 ft.

Building Separation: There are no buildings within 60 ft. of the Child Development Center.

Fire Resistive Requirements: For Type IIB construction, no fire rating of building elements is required.

Egress Requirements: No area of refuge is required. Dead end corridors are not allowed. Common path of travel shall not exceed 100 feet. The travel distance between any room door intended as an exit access and an exit shall not exceed 150 feet. The travel distance between any point in a room and an exit shall not exceed 200 feet. The travel distance between any point in a sleeping room and an exit access door in that room shall not exceed 50 feet.

Special Egress Requirements: Windows and doors in new addition spaces shall comply with NFPA 101, Section 17.2.11 with observance of the building being protected by an approved automatic sprinkler system in accordance with NFPA 101, Section 9.7.

Occupant Load: Occupant loading per classroom will not change relative to the building use and exiting provided. Egress capacity of building exits will remain in compliance with NFPA 101. Day Care Use occupant loading is 35 net square feet per person (NFPA 101, Table 7.3.1.2). Based on that, the 4 day care rooms added will increase the building occupant load by approximately 100 occupants based on 35 s.f. net in 3,430 s.f. These estimates are on the high side since the actual net square footage of additional classroom space is less than 3,430 s.f. with fixed furniture and cabinetry in place. Even with estimating a higher occupant load, exiting provided from each space is still adequate.

Fire Protection

Fire Pump: The use of this building is not changing. No change in the sprinkler demand is expected. A fire pump will not be added.

Automatic Fire Sprinkler: The CDC has an existing wet pipe sprinkler system. The existing system will be extended to provide the addition spaces at both ends of the CDC with automatic sprinkler protection in accordance with UFC 3-600-01 and NFPA 13 as referenced by UFC 3-600-01. Specifically, the existing 4-inch sprinkler system mains will be extended from where they currently terminate over room 12B and tees over room 28. New sprinkler branch line piping will protect the extensions.

Sprinklers shall match existing in finish as well as performance. Quick response sprinklers shall be used in classroom areas.

The inspectors test connection which penetrates the end wall of room 07A will be removed. A new inspectors test shall be provided penetrating the end wall of the new classroom adjacent to existing room 10. A splash block is recommended under the new inspectors test connection outlet.

Fire Alarm: The existing fire alarm panel will remain. The existing fire alarm system will be extended to provide coverage of the addition spaces at both ends of the CDC in accordance with UFC 3-600-01, NFPA 101, and NFPA 72 as referenced by UFC 3-600-01. Mass notification will not be provided as it is not within the scope of this contract. A limited building addition contract of this kind does not require the addition of a mass notification system. UFC 4-010-01 requires that mass notification is provided within the facility to the extent of providing real-time information to all building occupants or personnel in the immediate vicinity of a building during emergency situations of threats and what should be done in response to those threats. The existing systems for mass notification are still capable of achieving this goal i.e. phone tree, public address system, and manual corridor announcement.

The fire alarm control panel is a Simplex 4005 with a Simplex 4009 power extender panel next to the FACP in the main entrance / lobby area. Both panels are recessed in CMU block wall. These panels will remain as it is not within the scope of this contract to replace it with an updated system. The fire alarm control panel indicated status as all normal and on AC power during the team site visit on May 28, 2009.

Additional fire alarm equipment will include chimes, chime/strobes and spot-type smoke detectors in the corridor and in each new classroom space and notification appliance circuit power extender panels (if necessary) at each end. No chimes shall be installed in the classrooms.

The existing end-of-line resistors will be removed from approximately 12 existing notification appliances and located at new notification appliances on extensions of the existing fire alarm notification appliance circuits. The existing manual pull station at each end of the main corridors, at both ends of the building, will be removed.

The fire alarm transmitter is a Seaboard Systems, Transmitter/Junction Unit, Model TX-1/LC. The existing appliance will remain as it is not within the scope of this contract to replace it with an updated system.

Fire Extinguishers: Fire extinguishers shall be located in accordance with NFPA 101 and NFPA 10.