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**CUMBERLAND COUNTY SCHOOLS**

**CENTRAL COOLER/FREEZER REPLACEMENT**

**(PROJECT SPECIFICATIONS)  
BID SET  
8-17-22**

PREPARED

BY

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## TABLE OF CONTENTS

### **DIVISION 3 –CONCRETE**

- 03 10 00 Concrete Formwork
- 03 24 00 Fiber Reinforcement
- 03 25 00 Concrete Joints and Joint Accessories
- 03 30 00 Cast In Place Concrete
- 03 35 00 Concrete Finishes

### **DIVISION 11 –EQUIPMENT**

- 11 41 21 Walk-In Cooler/Freezer

### **DIVISION 26 –ELECTRICAL**

- 26 05 00 Electrical Materials and Methods
- 26 20 00 Cables and Wires

## SECTION 03 10 00

### CONCRETE FORMWORK

#### **PART 1 GENERAL**

##### **1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required and design, install and remove formwork for cast-in-place concrete complete as shown on the Drawings and as specified herein.
- B. Secure to forms or set for embedment all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts, water stops, hatches and other items furnished under other Sections and required to be cast into concrete.

##### **1.02 RELATED WORK**

- A. Concrete reinforcement is included in Section 03200.
- B. Concrete joints and joint accessories are included in Section 03250.
- C. Concrete finishes are included in Section 03350.

##### **1.03 SUBMITTALS**

##### **1.04 REFERENCE STANDARDS**

- A. American Concrete Institute (ACI)
  - 1. ACI 301 - Specifications for Structural Concrete
  - 2. ACI 318 - Building Code Requirements for Structural Concrete
  - 3. ACI 347 - Guide to Formwork for Concrete
- B. APA - The Engineered Wood Association (APA)
  - 1. Material grades and designations as specified
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

##### **1.06 SYSTEM DESCRIPTION**

- A. Definitions:
  - 1. Architectural concrete is defined as concrete for the following exposed reinforced concrete surfaces where architectural concrete is indicated on the Drawings:
    - a. Exterior: walls to 6-in below finish grade, beams, columns and underside of slabs.

- b. Interior: walls, beams, columns and underside of slabs visible in the finished structures.
  2. Structural concrete is defined as concrete that is not architectural concrete.
- B. Structural design responsibility: Contractor shall provide all forms and shoring designed by a professional engineer registered in the State of North Carolina. Design and erect formwork in accordance with the requirements of ACI 301, ACI 318 and ACI 347. Comply with all applicable regulations and codes. Consider any special requirements due to the use of plasticized and/or retarded set concrete.

## **PART 2 PRODUCTS 2.01**

### **GENERAL**

- A. The usage of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configurations desired.

## **2.02 MATERIALS**

### **A. Forms, General**

1. Make forms for cast-in-place concrete of wood, steel or other approved materials, except as specified in Paragraphs 2.02B and 2.02C.2. Construct wood forms of sound lumber or plywood free from knotholes and loose knots. Construct steel forms to produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels. Design and construct all forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing except as specified in Section 03350.

### **B. Forms for Exposed Concrete**

1. Make forms for all exposed and non-submerged exterior and interior concrete of new and unused Plyform exterior grade plywood panels manufactured in compliance with the APA and bearing the APA trademark, Provide B grade or better veneer on all faces to be in contact with concrete. Design and construct all forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing.
2. Provide rigid forms that will not deflect, move, or leak. Design forms to withstand the high hydraulic pressures resulting from rapid filling of the forms and heavy high frequency vibration of the concrete. Limit deflection to 1/400 of each component span. Lay out form joints in a uniform pattern.
3. Dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Tape, gasket, plug, and/or caulk all joints and gaps in forms to provide watertight joints that will withstand placing pressures without exceeding specified deflection limit or creating surface patterns.
4. Provide ¾ inch chamfer on all corners unless otherwise indicated.
5. Provide forms for circular structures that conform to the circular shape of the structure and where applicable the existing structure below. Straight panels may be substituted for circular panels if the straight panels do not exceed two feet in width, nor deflect more than 3-1/2 degrees per joint, nor conflict with specific notes indicated and panels conform with the existing structure below.

C. Column Forms (NOT USED)

D. Form Ties

1. Coil and Wire Ties: Provide ties manufactured so that, after removal of the projecting part, no metal remains within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a plastic or wooden cone at least 1/2-in diameter and 1-1/2-in long. Provide cone washer type form ties in concrete exposed to view.

### **PART 3 EXECUTION 3.01**

#### **GENERAL**

- A. Provide forms for all cast-in-place concrete including sides of footings. Construct and place forms to provide concrete of the shape, lines, dimensions and appearance indicated.
- B. Provide removable panels at the bottom of forms for walls and columns to allow cleaning, inspection and joint surface preparation. Provide closable intermediate inspection ports in forms for walls. Provide tremies and hoppers for placing concrete and to allow concrete sampling, prevent segregation and prevent the accumulation of hardened concrete on the forms and reinforcement above the fresh concrete.
- C. Place molding, bevels, or other types of chamfer strips to produce blockouts, rustications, or chamfers as indicated on the Drawings or as specified herein. Provide chamfer strips at horizontal and vertical projecting corners to produce a 3/4-in chamfer. Provide rectangular moldings at locations requiring sealants where shown on the Drawings or specified herein.
- D. Provide rigid forms to withstand construction loads and vibration and meeting specified deflection limits and tolerances. Construct forms so that the concrete will not be damaged by form removal.
- E. Accessories which remain embedded in the concrete after formwork removal will be subject to the approval of the Engineer. Permanent embeddings shall have sufficient concrete cover or be of suitable materials for the exposure condition as approved by the Engineer. Remove unsatisfactory embedded items at no additional cost to the Owner.

### **3.02 FORM TOLERANCES**

- A. Design, construct and surface forms in accordance with ACT 347 and meet the following additional requirements for the specified finishes.
- B. Forms for Exposed Concrete: Edges of all form panels in contact with concrete flush within 1/8-in and forms for plane surfaces plane within 1/8-in in 4-ft\_ Maximum deviation of the finished surface at any point not to exceed 1/4-in from the intended surface indicated. Arrange form panels symmetrically and orderly to minimize the number of seams. Provide tight forms to prevent the passage of mortar, water, and grout.
- C. Formed Surface Not Exposed to View or Buried: Class "C" Surface per ACT 347.
- D. Formed Surface Including Mass Concrete, Pipe Encasement, Electrical Raceway Encasement and Other Similar Installations: No minimum requirements for surface irregularities and surface alignment. The overall dimensions of the concrete shall be plus or minus 1-in from the intended surface indicated.

### **3.03 FORM PREPARATION**

- A. Clean, repair, remove projecting nails and fill holes, and smooth protrusions on all form surfaces to be in contact with concrete before reuse. Do not reuse forms for exposed concrete unless a "like new" condition of the form is maintained that will produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels.
- B. Coat wood forms in contact with concrete using form release agent prior to form installation.
- C. Clean steel forms by sandblasting or other method to remove mill scale and other ferrous deposits from the contact surface of all forms. Coat steel forms in contact with concrete using form release agent prior to form installation.

### **3.04 REMOVAL OF FORMS**

- A. Be responsible for all damage resulting from removal of forms and make repairs at no additional cost to the Owner. Leave in place forms and shoring for horizontal structural members in accordance with ACI 301 and ACI 347. Conform to the requirements for form removal specified in Section 03300.

### **3.05 INSPECTION**

- A. Notify the Engineer when the forms are complete and ready for inspection, at least six working hours prior to the proposed concrete placement. The Engineer will inspect the forms to ensure overall conformance with the contract documents.
- B. Failure of the forms to comply with the requirements specified, or to produce concrete complying with requirements specified shall be grounds for rejection of that portion of the concrete work. Repair or replace rejected work as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of these Specifications and approval of the Engineer.

**END OF SECTION**

## SECTION 03 24 00

### FIBER REINFORCEMENT

#### **PART 1 GENERAL**

##### **1.1 Section Includes**

- A. Fiber reinforcement for cast-in-place portland cement concrete for slabs on ground.

##### **1.2 Related Sections**

- A. Section 03300 Cast-in-Place Concrete.

##### **1.3 References**

- A. American Society for Testing and Materials (ASTM) C1116 Standard Specification for FiberReinforced Concrete, latest edition.
- B. American Concrete Institute (ACI) 360 Slabs on Ground, latest edition.

#### **PART 2 PRODUCTS**

##### **2.1 Manufacturer**

- A. The FORTA Corporation  
100 FORTA Drive  
Grove City, PA 16127  
(800) 245-0306  
[www.forta-ferro.com](http://www.forta-ferro.com)

##### **2.2 Fiber Reinforcement Description for FORTA-FERRO®**

- A. Fiber lengths are greater than 2.0 inches.
- B. Before mixing, fibers are collated by twisting with an initial bundle aspect ratio less than 20.
- C. Pre-mixing, macro monofilament fibers are bundled and have an aspect ratio of 80.
- D. Post mixing, fibers are dispersed and have an aspect ratio of 80 or greater.
- E. Fibers are made of copolymer virgin materials that are inert.
- F. Fibers are sized to be flexible and not stiff to ensure fibers 'lay down' and are easy to finish.

##### **2.3 Fiber Dosage**

- A. Add fiber reinforcement at these dosages:
  - 1. Dosage 3.0 lbs/cy; temperature and shrinkage reinforcement only.

##### **2.4 Batching and Mixing**

- A. After all or a portion of the concrete has been loaded into the truck or mixer, add fiber reinforcement by mixer ready dispersible bags at the prescribed dosage with the drum turning,.
- B. After fibers have been added, add water-reducing admixture (polycarboxylate superplasticizer).
- C. Follow ACI procedures to mix 5 minutes once all ingredients are in the drum.

#### **PART 3 EXECUTION**

### **3.1 Placement**

- A. Place concrete in accordance with provision of Section 03300 Cast-In-Place Concrete and with additional instructions as follows.
- B. Use slump testing as consistency truck to truck not as a measure of workability.

### **3.2 Finishing**

- A. Verify timing for final finish by impression depth into surface and other judgments to ensure proper finishing timing.
- B. Use steel/magnesium tools.

### **3.3 Schedules**

- A. Use fiber reinforced concrete in described locations scheduled as follows for each dosage.

END OF SECTION



SECTION 03 25 00

CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install accessories for concrete joints complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03100.
- B. Concrete reinforcement is included in Section 03200.
- C. Concrete finishes are included in Section 03350.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data for:
  - 1. Plastic Waterstops: Product data including sample, catalogue cut, technical data, storage requirements, splicing methods and conformity to CRD standards.
  - 2. Premolded joint fillers: Product data including location of use, sample, catalogue cut, technical data, storage requirements, installation instructions, and conformity to ASTM standards.
  - 3. Compressible joint filler: Product data including location of use, catalogue cut, technical data, storage requirements, installation instructions, and conformity to ASTM standards.
  - 4. Bond breaker: Product data including location of use, catalogue cut, technical data, storage requirements, and application instructions.
  - 5. Expansion joint dowels: Product data on the complete assembly including dowels, coatings, expansion dowel caps, installation instructions and conformity to ASTM standards.
  - 6. Sealant: Product data including location of use, catalogue cut, technical data, storage requirements, mixing and application instructions, and conformity to ASTM standards.
- B. Certifications
  - 1. Certify that all materials used within the joint system are compatible with each other.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

- 1. ASTM A615 — Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

3. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

C. Federal Specifications (FS)

1. FS SS-S-210A - Sealing Compound for Expansion Joints.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

## 1.05 QUALITY ASSURANCE

A. The CONTRACTOR is responsible for quality assurance with guidance from the ENGINEER.

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original, unopened containers displaying the manufacturer's label showing manufacturer name, product identification and batch number.
- B. Store products as recommended by the manufacturer.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. All materials used together in a given joint shall be compatible with one another. Coordinate selection of suppliers and products to provide compatibility. Do not use asphaltic bond breakers or asphaltic joint fillers in joints receiving sealant.
- B. All chemical sealant type water stops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used in similar applications for more than five years.

### 2.02 MATERIALS

A. Plastic Water stops

1. Water stops for expansion joints: 9-in by 3/8-in ribbed type water stops with a center bulb conforming to CRD C572 and made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of water stops 1750 psi. Water stops shall be style CR-9380 by Paul Murphy Plastics Co., Roseville, MI; style 696 by Greenstreak Plastic Products, St. Louis, MO; style RLB9-38 by Vinylex Corp., Knoxville, TN, or equal.
2. Water stops for non-expansion joints and other locations shown on the Drawings: 6-in by 3/8-in ribbed type water stops conforming to CRD C572 and made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of water stop 1750 psi. Water stops shall be style FR-6380 by Paul Murphy Plastics Co., Roseville, MI; style 679 by Greenstreak Plastic

Products, St. Louis, MO; style R6-38 by Vinylex Corp., Knoxville, TN, or equal.

B. Premolded Joint Filler

1. Premolded Joint Filler Structures: Self-expanding cork premolded joint filler conforming to ASTM D1752, Type III. Provide 1-in thickness unless otherwise indicated on the Drawings.

C. Bond Breaker

1. Bond Breaker Tape: Adhesive-backed glazed butyl or polyethylene tape which will adhere to the premolded joint filler or concrete surface. Provide tape the same width as the joint.
2. Bond breaker for concrete other than where tape is indicated on the Drawings or specified: Either bond breaker tape or a non-staining type bond prevention coating such as Crete-Lease Bond Breaker for Tilt-Up by Cresset Chemical Co.; Sure-Lift J-6 WB by Dayton Superior; Silcoseal Select by Nox-Crete, or equal.

D. Compressible Joint Filler

1. A non-extrudable watertight strip material used to fill expansion joints between structures. The material shall be capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in the first 1/2 hour after unloading. Compressible joint filler shall be Evazote 380 E.S.P, by E-Poxy Industries, Inc., Ravena, NY or equal.

E. Expansion Joint Dowels

1. Smooth undeformed steel bars conforming to ASTM A615, Grade 60. Provide dowels straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04-in on the diameter of the dowel and extends no more than 0.04-in from the end. Coat bars with a bond breaker on the expansion end of the dowel. Provide expansion dowel caps on the expansion end.
2. Expansion Dowel Caps: No. 87 Dowel Caps by Heckmann Building Products, Inc.; Style K11 Dowel Caps by the Dayton Superior Corporation; Style 3070 Expansion Tube by Meadow Steel Products, Inc., or equal.

F. Sealant

1. Provide sealant for joints in horizontal surfaces conforming to ASTM C920, Type S or M, Grade P or NS, Class 25. Provide sealant for joints in sloping and vertical surfaces conforming to ASTM C920, Type S or M, Grade NS, Class 25. Provide Use T sealant in pedestrian and vehicular traffic areas and Use NT in non-traffic areas.
2. Provide sealants made for use in continuous immersion in contact with potable water (nontoxic and free of taste and odor). Provide gray colored sealants unless otherwise indicated on the Drawings, specified, or approved.

## PART 3 EXECUTION

### 3.01 INSTALLATION

#### A. Waterstops - General

1. Install waterstops for all joints as shown on the Drawings. Provide waterstops continuous around all corners and intersections so that a continuous seal is provided.
2. Provide a minimum number of connections or splices.
3. Secure waterstops in joints before concrete is placed.
4. Install plastic waterstops so that half of the width will be embedded on each side of the joint. Provide waterstops completely embedded in void-free concrete.
5. Terminate waterstops 2-in below the exposed top of walls. Plug center bulbs in expansion joint waterstops with foam rubber, 1-in deep, at all points of termination.

#### B. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor must be submitted to the Engineer for written approval. Do not eliminate construction joints.
2. Locate additional or relocated joints where they least impair strength of the member. In general, locate joints within the middle third of spans of slabs, beams and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.
3. Unless indicated otherwise, provide joints perpendicular to main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings.
4. At all construction joints and at concrete joints indicated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to full amplitude (distance between high and low points and side to side) of 1/4-in with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by water blasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate the joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.
5. Provide waterstops in wall and slab construction joints in liquid retaining structures and at other locations shown on the Drawings.
6. Do not use keyways in construction joints unless specifically shown on the Drawings or approved by the Engineer.

#### C. Expansion Joints

1. Make expansion joints at locations indicated on the Drawings. Do not eliminate or relocate expansion joints.
2. Do not extend through expansion joints, reinforcement or other embedded metal items that are continuously bonded to concrete on each side of joint.
3. Position premolded joint filler material parallel to finished surfaces. Secure the joint filler against

displacement during concrete placement and consolidation. Place joint filler over the face of the joint, allowing for sealant grooves as indicated, Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as indicated on the Drawings.

4. Provide expansion joints 1-in in thickness unless otherwise indicated on the Drawings.
5. Where indicated on the Drawings install smooth dowels at right angles to expansion joints. Align dowels with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise indicated on the Drawings apply a bond breaker to one end of all dowels through expansion joints. Provide expansion dowel caps on the lubricated ends of expansion dowels.
6. Provide center bulb type waterstops, sealant grooves, and sealants in wall and slab expansion joints in liquid retaining structures and at other locations shown on the Drawings.

#### D. Control Joints

1. Make control joints at locations shown on the Drawings. Do not eliminate or relocate control joints.
2. Provide waterstops, sealant grooves, and sealants in wall and slab control joints in liquid retaining structures and at other locations shown on the Drawings.
3. Extend every other bar of reinforcing steel through control joints or as indicated on the Drawings. Coat the concrete surface with a bond breaker prior to placing new concrete against it as shown on the Drawings. Do not coat reinforcement or waterstops with bond breaker.

#### E. Sealant

1. Install sealants in clean dry recesses free of frost, oil, grease, form release agent, loose material, laitance, dirt, dust and other materials which will impair bond at the locations shown on the Drawings. Apply sealant conforming to the manufacturer's recommendations including concrete cure, temperature, moisture, mixing, primer, primer cure time, joint and recess preparation, tooling, and curing. Apply masking tape to each side of the joint prior to the installation of the sealant and remove afterwards along with any spillage to leave a sealant installation with neat straight edges.

#### F. Compressible Joint Filler

1. Install compressible joint filler in conformance with the manufacturer's recommendations; including surface preparation, adhesive installation, heat welding and set time.

END OF SECTION

SECTION 03 30 00  
CAST-IN-PLACE CONCRETE

PART 1 GENERAL 1.1

SUMMARY

Perform all work in accordance with ACI 318.

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.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2010; Errata 2011) Specifications for Structural Concrete
ACI 302.1R	(2004; Errata 2006; Errata 2007) Guide for Concrete Floor and Slab Construction
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2010) Guide to Cold Weather Concreting
ACI 318	(2011; Errata 1 2011; Errata 2 2012; Errata 3-4 2013) Building Code Requirements for Structural Concrete and Commentary
ACI 347	(2004; Errata 2008; Errata 2012) Guide to Formwork for Concrete
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2013) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A615/A615M	(2014) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM C1064/C1064M	(2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C143/C143M	(2012) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C1602/C1602M	(2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C172/C172M	(2014) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2014a) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C685/C685M	(2011) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C94/C94M	(2014a) Standard Specification for Ready-Mixed Concrete
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM E1155	(2014) Standard Test Method for

Determining Floor Flatness and Floor Levelness

## Numbers

ASTM E1155M	(2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers (Metric)
ASTM E1643	(2011) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2011) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
ASTM E96/E96M	(2013) Standard Test Methods for Water Vapor Transmission of Materials

## U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials
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### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

- Water-Reducing or Retarding Admixture
- Conveying and Placing Concrete
- Formwork
- Ready-mix Concrete
- Mix Design Data
- Air-Entraining Admixture
- Measurement of Floor Tolerances
- Vapor Barrier

#### SD-06 Test Reports

- Concrete Mixture Proportions Compressive Strength Testing Slump

#### SD-07 Certificates

- Cementitious Materials Aggregates

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Flatness and Levelness of Floor Slabs

Conduct floor flatness and levelness test, (FF and FL respectively), on floor slabs in accordance with the provisions set forth in ASTM E1155M or ASTM E1155. Make floor tolerance measurements by the approved laboratory and inspection service within 24 hours after completion of final troweling operation and before forms and shores have been removed. Provide results of floor tolerance tests, including formal notice of acceptance or rejection of the work, to the Contracting Officer within 24 hours after data collection.

## PART 2 PRODUCTS



## 2.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test joint sealer, joint filler material, waterstop, aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M.

### 2.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength,  $f_c$ , but not more than 20 percent, and no individual acceptance test result falls below  $f_c$  by more than 500 psi.

### 2.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in ACI 117.

### 2.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength  $f_c$  is 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 3/4 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water-cementitious material ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

## 2.2 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

### 2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

#### 2.2.1.1 Portland Cement

ASTM C150/C150M, Type I, IA, II, or IIA. 2.2.2

#### Aggregates

For fine and coarse aggregates meet the quality and grading requirements of ASTM C33/C33M. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

### 2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

#### 2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

#### 2.2.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

### 2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; potable, and free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

### 2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66. Provide mechanical reinforcing bar connectors in accordance with ACI 301 and provide 125 percent minimum yield strength of the reinforcement bar.

### 2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to ASTM D1752, Type I.

### 2.2.7 Formwork

Design and engineer the formwork as well as its construction in accordance with ACI 301 Section 2 and 5 and ACI 347. Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

### 2.2.8 Form Coatings

Provide form coating in accordance with ACI 301.

### 2.2.9 Vapor Barrier

ASTM E1745 Class A polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

### 2.2.10 Curing Materials

Provide curing materials in accordance with ACI 301, Section 5.

## 2.3 Surface Sealer

Concrete sealer shall be non-yellowing, clear acrylic-based sealer.

2.3.1 Performance: Concrete sealers shall meet or exceed the following:

- a. Coverage: As recommended by manufacturer.
- b. Moisture Retention, Test ASTM C 309: 0.21kg/m<sup>2</sup> at 200 ft<sup>2</sup> per gallon and 0.32 kg/m<sup>2</sup> at 300 ft<sup>2</sup> per gallon.
- c. Finish: Provide Class B finish throughout facility.
- d. Tg: 50 degrees C.
- e. Tukon Hardness: 30 minutes at 180 degrees F, 9.3; 30 degrees F, 13.7, minutes at 300
- f. Pencil Hardness: 30 minutes at 180 degrees F, F; 30 degrees F, H. minutes at 300
- g. Spray Conditions, Viscosity: 19 seconds, No. 2 Zhan cup.
- h. Abrasion Resistance: 160 mg lost, CS-17 wheel, 1000 cycles. g load, 1000

## 2.4 READY-MIX CONCRETE

Provide ready-mix concrete with mix design data conforming to ACI 301 Part 2. Submit delivery tickets in accordance with ASTM C94/C94M for each ready-mix concrete delivery, include the following additional information:

- a. Type and brand cement
- b. Cement content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixture
- e. Total water content expressed by water cementitious material ratio 2.5 ACCESSORIES

### 2.5.1 Curing Compound

Provide curing compound conforming to ASTM C309. Submit manufactures instructions for placing curing compound.

## PART 3 EXECUTION 3.1

### PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

#### 3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed.

Provide all equipment needed to place,

### CAST IN PLACE CONCRETE

consolidate, protect, and cure the concrete at the placement site and in good operating condition.

### 3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

### 3.1.3 Vapor Barrier Installation

Install in accordance with ASTM E1643. Apply vapor barrier over gravel fill. Lap edges not less than 6 inches. Seal all joints with pressure-sensitive adhesive not less than 2 inches wide. Protect the vapor barrier at all times to prevent injury or displacement prior to and during concrete placement.

### 3.1.4 Production of Concrete

#### 3.1.4.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

#### 3.1.4.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to ASTM C685/C685M.

## 3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with ACI 301, Section 5.

### 3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with ACI 306R

### 3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with ACI 305R 3.3 FINISHING

### 3.3.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 36 degrees F.

### 3.3.2 Finishing Formed Surfaces

Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Ream or chip surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete and fill with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. Use a blend of portland cement and white cement in mortar or concrete for repairs to all surfaces permanently exposed to view shall be so that the final color when cured is the same as adjacent concrete.

### 3.3.3 Finishing Unformed Surfaces

Finish unformed surfaces in accordance with ACI 301, Section 5.

FINISH	LOCATION
Float	
Trowel	
Broom or Belt	

### 3.3.3.1 Flat Floor Finishes

In accordance with ACI 302.1R, construct in accordance with one of the methods recommended in Table 7.15.3, "Typical Composite FF/FL Values for Various Construction Methods." ACI 117 for tolerances tested by ASTM E1155M or ASTM E1155. These requirements are based upon the latest FF/FL method.

#### 3.3.3.1.1 Floor Slabs

Conform floor slabs on grade to the following ACI F-number requirements unless noted otherwise:

Specified Overall Values	FF30/FL23 minimum
Minimum Local Values	FF17/FL15 minimum

#### 3.3.3.1.2 Subject to Vehicular Traffic

Floor slabs on grade subject to vehicular traffic or receiving thin-set flooring shall conform to the following ACI F-number requirements:

Specified Overall Values	FF35/FL25 minimum
Minimum Local Values	FF25/FL17 minimum

### 3.3.3.2 Measurement of Floor Tolerances

Test floor slabs within 24 hours of the final troweling. Submit test results to Contracting Officer within 12 hours after collecting data. Floor flatness inspector must provide a tolerance report which includes:

- a. Name of Project
- b. Name of Contractor
- c. Date of Data Collection
- d. Date of Tolerance Report
- e. A Key Plan Showing Location of Data Collected
- f. Results Required by ASTM E1155M ASTM E1155

### 3.3.3.3 Expansion and Contraction Joints

Make expansion and contraction joints in accordance with the details shown or as otherwise specified. Provide 1/2 inch thick transverse expansion joints where new work abuts an existing concrete. Provide expansion joints at a maximum spacing of 30 feet on center in sidewalks, unless otherwise indicated. Provide contraction joints at a maximum spacing of 6 linear feet in sidewalks and at a maximum spacing of 15 feet in slabs, unless otherwise indicated. Cut contraction joints at a minimum of 1 inch(es) deep with a jointing tool

after the surface has been finished.

### 3.4 CURING AND PROTECTION

Cure and protect in accordance with ACI 301, Section 5.

#### 3.4.1 Surface Sealing

##### 3.4.1.1 Preparation

Inspection: Prior to start of application, inspect existing conditions to ensure surfaces are suitable for installation including the following:

- a. Concrete has cured for a minimum of 28 days prior to application of sealer.
- b. Surface is completely free of sealers, oils, dirt, paint, alkali, penetrating sealers and foreign materials that would prevent the sealer from penetrating the concrete surface.
- c. Concrete has been swept clean.
- d. Test area has been approved. 3.4.1.2

##### Application

Concrete Sealer: Strictly comply with manufacturer's installation recommendations including the following:

- a. Apply after stain has dried at rate recommended by manufacturer.
- b. Clean surface as recommended by manufacturer.
- c. All concrete flatwork designated as being sealed in the plans and specifications shall be sealed with 2-3 even coats of sealer, at the rate of approximately 150 to 200 square feet per gallon.

##### 3.4.1.3 Cleaning and Protection

Protection: Do not cover, but protect floor area from paint and other contaminants that could inhibit the sealer.

### 3.5 FORM WORK

Provide form work in accordance with ACT 301, Section 2 and Section 5.

#### 3.5.1 Removal of Forms

Remove forms in accordance with ACT 301, Section 2.

### 3.6 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

#### 3.6.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACT 318 and ACT SP-66. Provide shop details and bending in accordance with ACT 318 and ACT SP-66.

#### 3.6.2 Splicing

Perform splices in accordance with ACT 318 and ACT SP-66.

### 3.6.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

## 3.7 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

## 3.8 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period. See Section 01 33 00 SUBMITTAL PROCEDURES.

### 3.8.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

### 3.8.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

### 3.8.3 Sampling and Testing

- a. Provide samples and test concrete for quality control during placement. Sample fresh concrete for testing in accordance with ASTM C172/C172M. Make six test cylinders.
- b. Test concrete for compressive strength at 7 and 28 days for each design mix and for every 100 cubic yards of concrete. Test two cylinders at 7 days; two cylinders at 28 days; and hold two cylinders in reserve. Conform test specimens to ASTM C31/C31M. Perform compressive strength testing conforming to ASTM C39/C39M.
- c. Test slump at the site of discharge for each design mix in accordance with ASTM C143/C143M. Check slump once during each shift that concrete is produced.
- d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or extremely porous aggregates in accordance with ASTM C173/C173M. Check air content at least once during each shift that concrete is placed.
- e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M. Check concrete temperature at least once during each shift that concrete is placed.

### 3.8.4 Action Required

#### 3.8.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

#### 3.8.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-

entrainment admixture prior to delivery of concrete to forms.

#### 3.8.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

END OF SECTION



SECTION 03 35 00

CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE, OF WORK.

- A. Furnish all labor, materials, equipment and incidentals required and finish cast-in-place concrete surfaces as specified herein, unless otherwise shown on the drawings.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03100.
- B. Concrete reinforcement is included in Section 03200.
- C. Concrete joints and joint accessories are included in Section 03250.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
  - 1. Concrete sealer. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations and Material Safety Data Sheet. Also submit confirmation that the sealer is compatible with additionally applied coatings.
  - 2. Chemical hardener. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations and Material Safety Data Sheet. Also submit confirmation that the hardener is compatible with sealer.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Services of Manufacturer's Representative
  - 1. Make available at no additional cost to the Owner, upon 72 hours notification, the services of a qualified field representative of the manufacturer of sealer or hardener to instruct the contractor on the proper application of the product under prevailing job conditions.

1.06 RESPONSIBILITY FOR CHANGING FINISHES

- A. The surface finishes specified for concrete to receive coatings or other finish materials are those required for the proper application of the products specified under other Sections. Where products different from those specified are approved for use determine if changes in finishes are required and

provide the proper finishes to receive these products.

- B. Perform changes in finishes made to accommodate products different from those specified at no additional cost to the Owner. Submit the proposed new finishes to the Engineer for approval.

#### 1.07 SITE MOCK-UPS (IF REQUESTED)

- A. Provide a 10 sq ft minimum area with the proposed finish for the approval of the Engineer before proceeding with finishing of a complete area. Provide 2 working days notification for the Engineer to have the proper personnel at the site for evaluation during actual finishing of the mock-up.
- B. Modify techniques and equipment to achieve an approved finish.
- C. When approved, the area will be recorded on drawings and will become the standard of acceptance for that finish for the project.
- D. Provide similar procedures for each finish as directed.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Cementitious and component materials required for finishing concrete surfaces: As specified in Section 03300.
- B. Chemical hardener: Lapidolith by BASF Building Systems; Homolith by Tamms; Surthard by the Euclid Chemical Co. or equal fluosilicate base material.
- C. Concrete sealer: A penetrating silicate-based liquid densifier and sealer. Euco Diamond Hard by the Euclid Chemical Company; Protecrete Densifier by Applied Concrete Technology Inc.; Sikagard 701W by Sika Corp.; or equal.

### PART 3 EXECUTION

#### 3.01 FORMED SURFACES

- A. Form removal: Conform to Sections 03100 and 03300.
- B. Do not damage edges or obliterate the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
- D. Off-Form Finish
  - 1. Remove fins and other projections and fill tie cones and defects as specified in Section 03300.
- E. Rubbed Finish
  - 1. Immediately upon stripping forms and before concrete changes color, carefully remove all fins with a hammer. While the surface is still damp apply a thin coat of medium consistency neat cement slurry using bristle brushes to provide a bonding coat within all pits, air holes or

blemishes in the parent concrete. Do not coat large areas of the surface with this slurry.

2. Before the slurry dries or changes color, apply a dry (almost crumbly) grout consisting of one volume cement to 1-1/2 volumes of clean masonry sand having a fineness modulus of approximately 2.25 and complying with the gradation requirements of ASIM C144. Apply grout uniformly using damp (neither dripping wet nor dry) pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in the imperfections to be patched.
3. Allow the mortar to partially harden for one or two hours depending upon the weather. If the air is hot and dry, keep the surface damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the perpendicular edge of a steel trowel without damaging the grout in the small pits or holes, cut off all grout that can be removed with a trowel. Grout allowed to remain on the surface too long will get too hard and will be difficult to remove.
4. Allow the surface to dry and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout should remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow grout to dry after it has been cut off with the trowel so it can be wiped off clean with the burlap.
5. On the day following the repair of pits, air holes and blemishes, the surfaces again shall be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, a built-up film remains, use a fine abrasive stone to remove all such material without breaking through the surface film of the original concrete. Scrub lightly to remove excess material without working up a lather or mortar or changing the texture of the concrete.
6. Follow the final bagging or stoning operation with a thorough wash-down with stiff bristle brushes to remove extraneous materials from the surface. Spray the surface with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.
7. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality and without surface voids.

### 3.02 FLOORS AND SLABS

- A. Consider the potential for longer setting time in concrete containing fly ash.
- B. Compact with internal vibrators as specified in Section 03300 and screed to the established grades. Provide floors and slabs level with a tolerance of 1/8-in when checked with a 1241 straightedge, except where drains occur, in which case pitch floors to drains as indicated. Failure to meet either of above shall be cause for removal, grinding, or other correction as directed by the Engineer, at no additional cost to the Owner.
- C. Following screeding as specified above, float the slabs as approved by the Engineer. Continue floating operation until sufficient mortar is brought to the surface to fill all voids. Test the surfaces with a straightedge to detect high and low spots which shall be eliminated. Do not overwork the concrete as evidenced by excess water and fine material on the surface.
- D. Do not use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate away from the surface and allowing a layer of mortar to accumulate on any slab finish. Do not dust

surfaces with dry materials. Round of all edges of slabs and tops of walls with a steel edging tool. Use steel edging tool with radius of 1/4-in for all slabs subject to wheeled traffic.

- E. Measure floor flatness the day after a concrete floor is finished and before the shoring is removed, in order to eliminate any effects of shrinkage, curling and deflection. A 12-ft long straightedge shall be supported at each end with steel gauge blocks whose thickness are equal to tolerance specified. Floor surface shall not have crowns so high as to prevent 12-ft straightedge from resting on the two end blocks, nor low spots so low that a third block of twice the tolerance in thickness can pass under the supported straightedge. Compliance with the designated limits in four of five consecutive measurements will confirm compliance, unless obvious faults are observed. A check for adequate slope and drainage will also be made to confirm compliance.

F. Descriptions

1. Steel Trowel Finish. Finish by screeding and floating with straightedges to bring the surfaces to the elevations indicated. While the concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, the surface shall be wood floated to a true, even plane with no coarse aggregate visible. Apply sufficient pressure on the wood floats to bring moisture to the surface. After surface moisture has disappeared, hand steel trowel to produce a smooth, impervious surface, free from trowel marks. Trowel the surface again for the purpose of burnishing. The final troweling shall produce a ringing sound from the trowel. Do not use dry cement or additional water in troweling.
2. Wood Float Finish. Finish by screeding with straightedges to bring the surfaces to the elevations indicated. Use a wood float to compact and seal surface. Remove all laitance and leave a clean surface.
3. Light Broomed Finish. Steel trowel finish the concrete, as specified above but omit the final troweling and finish the surface by drawing a fine-hair broom lightly across the surface. Broom in the same direction and parallel to expansion joints, or in the case of inclined slabs, perpendicular to the slope, or except as directed otherwise.
4. Broomed Finish. Steel trowel finish the concrete, as specified above but omit the final troweling. While the concrete is still soft enough, finish the surface with a stiff coarse fiber broom to produce the pattern and depth of scoring as approved by the Engineer.
5. Power Machine Finish. In lieu of hand steel trowel finishing, an approved power machine for finishing concrete floors and slabs may be used in accordance with the directions of the machine manufacturer and as approved by the Engineer. Do not use a power machine until the concrete has attained the necessary set to allow finishing without introducing high and low spots in the slab. Hand steel trowel the areas of slabs not accessible to power equipment. Provide a final steel troweling done by hand over all areas.

G. Concrete Sealer

1. Prepare and seal surfaces indicated on the Drawings to receive a sealer as follows:
  - a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule of Finishes in Paragraph 3.05 below.
  - b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application-ready when it is damp but not wet and can no longer be marred by walking workers.
  - c. Newly-Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust,

droppage, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that surface is no more than damp, and not wet.

- d. Existing Concrete: Restore surface soundness by patching, grouting, and filling cracks and holes. Surface must also be free of any dust, dirt and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required, following the procedure indicated under cured concrete.
- e. Application: Apply sealer so as to form a continuous, uniform film by spray, soft-bristle pushbroom, long-nap roller, lambswool applicator, or ordinary garden-type sprayers.
- f. For curing only, two coats are required. Apply first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq ft per gallon. Apply second coat when all trades are completed and structure is ready for occupancy at the rate of 400 to 600 sq ft per gallon.
- g. To seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full-strength. On aged concrete, when renovating, dustproofing and sealing, the first coat should be thinned 10 to 15 percent with reducer per manufacturer's directions.

### 3.03 CONCRETE RECEIVING CHEMICAL HARDENER

- A. After 28 days, minimum, concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 100 sq ft per gallon and in accordance with manufacturer's recommendations as reviewed.

### 3.04 APPROVAL OF FINISHES

- A. All concrete surfaces, when finished, will be inspected by the Engineer.
- B. Refinish or rework unsatisfactory finishes until approved by the Engineer, at no additional cost to the Owner.
- C. Hardened unsatisfactory finishes will require removal, grinding, or other appropriate correction approved by the Engineer, at no additional cost to the Owner.

### 3.05 SCHEDULE OF FINISHES

- A. Finish concrete in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section. Where products different from those specified are approved for use comply with the requirements of Paragraphs 1.06A and 1.06B.
- B. Finishes to the base concrete for the following conditions shall be as scheduled below and as further specified herein:
  - 1. Concrete for exterior on sidewalk and other horizontal areas - Broomed finish, non-slip.
  - 2. Exposed interior concrete - Broomed finish.
  - 3. Concrete for interior walking surfaces excluding stairs — Broomed finish, non-slip.
  - 4. Tops of curbs and pads - Steel trowel finish.
  - 5. Concrete to receive paint - Rubbed finish.

6. Concrete to receive floor sealer - See Paragraph 3.02 G above.
7. Concrete to receive ceramic and quarry tile - Broomed finish as approved.
8. Concrete to receive vinyl and rubber surfacing and carpet - Steel trowel finish.

END OF SECTION

## SECTION 11 41 21

### WALK-IN COOLER/FREEZER

1. - Sectional outdoor walk-in cooler and freezer complete with internal steel support and refrigeration, shall be manufactured by Bally Refrigerated Boxes, Inc. or approved equal by US Cooler or Master- Bilt. Overall size of freezer to be 57' 7" x 26' 11" x 13' 8" high. The boxes shall be two (2) compartment, divided as per drawing.
2. - 4" foam core panels shall be Underwriters Laboratories-listed as having flame spread of 25 or lower and smoke generation of 450 or lower when tested in accordance with ASTM E-84-76. Panels shall be approved by Factory Mutual as a Class 1 building type. They shall be manufactured with foamed in place CFC free Enovate 3000, or Solstice foam system in accordance with the 2009 Federal Energy Standards (EISA).
3. - All work and materials shall fall in full accordance with local and or state ordinances, and with any other prevailing rules and regulations. The manufacturer is not responsible for furnishing items required by these regulations, unless specified or shown on the drawings or contained in the specifications.
4. - Panels shall consist of interior and exterior metal skins precisely foamed with steel dies and roll-form equipment and thoroughly checked with gauges for accuracy. Metal skins shall be treated on the inside surface with a bonding agent to ensure a stable adhesion with the chemical bonding agents of the urethane. The metal skins shall be placed into heated molds and liquid urethane injected between them. Urethane shall be Enovate 3000, or Solstice foamed in place (poured, not frothed) and, when completely cured, shall bind tenaciously to metal skins to form an insulated panel. Panels shall contain 100% urethane insulation and have no internal wood or structural members between skins unless required to meet wind loads or snow load calculations.. To insure tight joints, panel edges must have foamed-in-place tongues and grooves with a flexible vinyl gasket **foamed-in-place** on the interior and exterior of all tongue edges. Gaskets shall be resistant to damage from oil, fats, water and detergents and must be NSF-approved. Gaskets shall not be stapled or glued to metal skins.
5. - Insulation shall be rigid urethane "Foamed-in-Place". Insulation shall have a minimum R-Value of R32 for freezers. These R-values shall be determined as per Section 312 of the EISA code. For calculating the R-value of the freezer, the K-factor of the foam at 20° F. (average foam temperature) shall be used. For calculating the R-value of the cooler, the K-factor of the foam at 55° F. (average foam temperature) shall be used.
- 6 - All panels except corner panels shall be made in 23" and 46" widths, fully interchangeable for fast, easy assembly. Panels 11-1/2", 17-1/4", or 34-1/2" wide are to be furnished only if required to fit allocated space. To assure perfect alignment and maximum strength, corner panels shall employ a right angle configuration with exterior horizontal dimensions of 12" on each side.
7. - Panels shall be equipped with Speed-Lok diaphragmatic joining devices. The distance between locks shall not exceed 46". Each device shall consist of a cam action, hooked locking arm placed in one panel, and a steel rod positioned in the adjoining panel, so that when the arm is rotated, the hook engages the rod and draws the panels tightly together with cam action. Arms and rods shall be housed in individual steel pockets. Pockets on one side of the panel shall be connected to pockets on the other side in width, by use of **2" wide metal straps** set into and completely surrounded by insulation. When panels are joined together, these straps shall form lock-to-lock connections for superior strength. Locking device shall be accessible from the inside to facilitate installations in confined areas, and shall be provided with **flush** press-fit caps. *Surface mounted plastic plugs will not be accepted.*

**8. - Exterior Finish** to be stucco embossed **white** (190 series) steel. Also a Tapered / Sloped roof kit and Dura-last roof cap to be furnished as well.

**9. - Interior Finish** to be stucco embossed **white** (190 series) steel. Ceilings to be stucco embossed **white** galvanized steel.

**10. - Floor Construction and Finish** - An insulated concrete slab by others.

**11. - Entrance Opening** – Cumberland County to provide opening in the building to allow access to the cooler and freezer.

**11a. Doors** – Doors will be 60” x 84” with **reinforced U-Channel steel frame** with a thermal breaker that prevents twisting, sagging, and eliminates the need for structural members. Heavy duty hardware also will be provided. Doors to have 1/8 diamond aluminum kick plates 36” high, in and out on door and frame.

**11b. Accessories** - (10) 48” LED Keil lights 48x754-CL-N, shall be provided. Freezer to include size sufficient pressure relief port. (2) Strip curtains for 60” door.  
2257 lbs of Internal Steel structure to be provided with 135 L/F 3” ID Pipe post.

## **12. Mechanical Refrigeration**

Preassembled Remote Scroll systems shall be provided. Systems shall be UL approved as systems (not components only). All systems shall utilize R-448A refrigerant. Walk-ins must be able to maintain -10° F. operating temperature in the freezer with a maximum run time of 18 hours under normal operating conditions (taking into consideration opening and closing of doors). And cooler shall operate at 35 degree F. Unit shall be furnished with low-ambient kit for outdoor installation.

**Freezer** to have a Bally BMP233LE-S2D SV+ 208-230/1/60 with EEV installed, Smart-Speed evaporator (208-230/1/60) with a 7.5 HP air-cooled BEZA 075L8 HT3DN 208-230/3/60 for use with SmartVap+ scroll condensing unit (208-230/3/60) designed for outdoor operation or approved equal by Master-Bilt, US Cooler (see refrigeration spec provided)

**Cooler** to have Bally BLP211ME-S2D SV+ 208-230/1/60 with EEV installed, Smart-Speed evaporator (208-230/1/60) with a 1 HP air-cooled BEZA 0010H8 HT3DB 208-230/3/60 scroll condensing unit (208-230/3/60) designed for outdoor operation or approved equal by Master-Bilt, US Cooler. (see refrigeration spec provided)

**Evaporators** to be provided with two-speed EC fan motors with Smart-Speed™ technology.

All penetrations for electrical and refrigeration lines shall be cut and sealed in field by the installing contractor.

## **13. Warranties**

Manufacturer shall warrant that any part of the structure it supplies (except the refrigeration system and its related accessories) is free from defects in materials or workmanship under normal use and service. The insulated panel portion of the structure is warranted to be free from defects under normal use and service for a period of 10 years from date of installation. (but in no event shall the warranty be in force for more than 10 years and 6 months from date of initial shipment from manufacturer). Panel surface condition is warranted free from defects under normal use and service for one year from installation, provided the panels are stored and installed in accordance with manufacturers instructions. Mechanical (including hardware, gasketing, Speed-lok assemblies, aluminum weather roofs) and electrical components, except refrigeration systems (which are covered by a separate warranty) are warranted to be free from defects under normal use and service for one year from date of installation. (In no case shall this



portion of the warranty be in force for more than one year and six months from date of initial shipment from manufacturer). The warranty shall not include any labor charges for replacement or repair of defective parts or refrigeration. Full warranty information is to be provided with the walk-in.

Refrigeration system shall be warranted for 12 months with an optional 5 year compressor warranty available.

## SECTION 26 20 00

### CABLES AND WIRES

#### PART 1 - GENERAL

#### PART 2 - PRODUCTS

##### 2.1 CABLE (MEDIUM VOLTAGE PRIMARY) (NOT APPLICABLE)

- A. Primary cable shall be single conductor stranded copper, with ethylene propylene rubber (EPR) insulation rated 15kV, 90 degrees C, 133 percent insulation level, a 5-mil thick minimum tape shield with 12-1/2 percent minimum overlap, and a polyvinyl chloride (PVC) jacket. The cable shall be suitable for use on a 13.2 kV, 3-phase, 3-wire, ungrounded, system. General, Kerite, Okonite, or Southwire.

##### 2.2 CABLE AND WIRE (600 VOLTS AND BELOW)

- A. Secondary distribution and power cable shall be single conductor stranded copper, No. 12 AWG minimum; with NEC Type THHN insulation rated 90 degrees C, 600 volts. Alan Wire, American Insulated Wire, General, Cerro Wire, Encore, Republic Wire, Rockbestos, Service Wire, or United Copper Industries.
- B. Lighting wire for above ground use shall be single conductor stranded copper, No. 12 AWG minimum, with NEC Type THHN insulation rated 90 degrees C, 600 volts. Alan Wire, American Insulated Wire, General, Cerro Wire, Encore, Republic Wire, Rockbestos, Service Wire, or United Copper Industries.
- C. Lighting wire for underground use in conduit shall be single conductor stranded copper, No. 12 AWG minimum, with NEC Type XHHW insulation rated 90 degrees C in dry locations and 75 degrees C in wet locations, 600 volts. American Insulated Wire, General, Cerro Wire, Encore, Republic Wire, Rockbestos, Service Wire, or United Copper Industries.
- D. Control cable shall be single conductor stranded copper No. 14 AWG minimum; with NEC Type THHN insulation rated 90 degrees C, 600 volts.
- E. Instrumentation and special systems wire shall be in accordance with manufacturers' recommendations, but shall not be less than 20 AWG.
- F. Type MC cable shall be made up of individual conductors as noted above, be color coded, include a separate ground conductor, and shall have a corrugated metal armor over its entire length.

#### PART 3 - EXECUTION

##### 3.1 INSTALLATION REQUIREMENTS

- A. Install all cables and wires (including telecommunications, low voltage control and power limited circuits) in raceways. Telecommunications raceways shall be continuous from outlet boxes to telecommunications rooms or cable trays.
- B. Use cable lubricant when pulling primary cables and secondary feeder cables. Avoid exceeding manufacturer's recommendations on pulling tensions; sidewall pressures and cable bend radii.

- C. Segregate wiring of different voltage levels. Except as follows, circuits operating at different voltages shall not share raceways.
  - 1. Power wiring to rooftop motors and rooftop receptacles may be routed together.
- D. Splice power cables with solderless compression butt splices or ring lugs. Terminate power cables including motor leads with solderless compression ring lugs. Splice branch circuit wiring, lighting wiring, and control and instrumentation wiring with wire nut connectors. Terminate control and instrumentation wiring with solderless compression ring or spade lugs. Compression connectors and lugs shall be crimped with tools specifically designed for the terminations being crimped.
- E. If no color coding system exists for each indicated system function and voltage, color code circuits as follows:
  - 1. Three Phase Power Over 600 Volts:
    - Phase X (A): Black
    - Phase Y (B): Red
    - Phase Z (C): Blue
  - 2. Three Phase Power 480/277 Volts:
    - Phase X (A): Brown
    - Phase Y (B): Orange
    - Phase Z (C): Yellow
    - Neutral: Gray
    - Ground: Green
  - 3. Three Phase Power 208/120 Volts:
    - Phase X (A): Black
    - Phase Y (B): Red
    - Phase Z (C): Blue
    - Neutral: White
    - Ground: Green
  - 4. Single Phase Power 240/120 Volts:
    - Phase X (A): Black
    - Phase Y (B): Red
    - Neutral: White
    - Ground: Green
  - 5. Control wires to light fixtures for light dimming shall be:
    - a. 'Hot control wire' - Black with white stripe
    - b. 'Neutral control wire' - White with Black stripe
  - 6. Less Than 120 Volts: Use Industry Standard Methods
- F. Provide home runs of No. 10 AWG wire for 20-amp branch circuits that exceed 150' in length.
- G. Ground the shields of shielded instrumentation and control cables at one end only. The shields at the other end shall be insulated from ground.
- H. Provide identification tags on all cables and conductors terminated in panels.

END OF SECTION

## SECTION 26 05 00

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provide conduits, cable trays, surface raceways, boxes, fittings and supports to form a complete, coordinated, and continuously grounded raceway system.

##### 1.2 CONDUIT REQUIREMENTS

- A. Conduits indoors in hazardous areas, encased in concrete floor slabs or subjected to water, physical damage or abuse shall be galvanized rigid steel (GRS).
- B. Conduits underground outdoors shall be schedule 40 pvc
- C. Exposed conduits shall be RMC.
- D. Indoor homerun circuits shall be in EMT. Electrical whips from devices to junction boxes shall be MC cable and shall be 8' max in length.
- E. Final connections to motors, transformers and equipment subject to vibration or removal for maintenance shall be 1/2" minimum liquid tight flexible metallic conduit with steel liquid tight fittings. Transformer connections may be non-liquid tight flexible metallic conduit in electrical rooms only.

##### 1.3 SURFACE RACEWAY REQUIREMENTS

- A. When conduits in finished areas cannot be concealed in walls or above ceilings, surface raceways may be used where permitted. Boxes and fittings shall match and be from the same manufacturer as the raceways.

##### 1.4 BOX REQUIREMENTS

- A. Provide cast or malleable iron outlet boxes and covers for galvanized rigid steel conduits.
- B. Boxes shall be sized for all conductors and devices to be contained within. Box extensions shall not be used to correct for undersized boxes.

##### 1.5 SUPPORT REQUIREMENTS

- A. Surface mounted equipment shall be secured to steel channels. The channels shall be attached with toggle bolts to hollow tile, block or similar surfaces, and attached with screws or bolts and expansion shields to solid masonry or concrete.

#### PART 2 - PRODUCTS

##### 2.1 CONDUITS

- A. EMT shall be hot dipped galvanized inside and outside, in 10' lengths and threaded on both ends. Fittings and bushings shall be cast or malleable iron, and hot dipped galvanized inside and outside.

- B. Flexible metallic conduit shall be galvanized steel or aluminum. Fittings shall be of steel with cadmium or galvanized finish. Fittings shall be machine screw clamp type, single or two-piece. Self-locking, twist-in type fittings are not acceptable.
- C. Liquid tight flexible metallic conduit shall consist of a flexible, galvanized steel core, a continuous copper ground strip and a polyvinyl chloride jacket. Fittings shall be steel liquid tight grounding type from the same manufacturer as the conduit.

## 2.2 SURFACE RACEWAYS

- A. Where surface raceways are called for on the drawings, or when conduits in finished areas cannot be concealed in walls or above ceilings, surface raceways shall be used. Boxes and fittings shall match and be from the same manufacturer as the surface raceway.
- B. Surface raceways shall consist of a base and cover, sized for the number of conductors contained within, complete with all connectors, fittings, bushings, boxes, covers and mounting hardware.
- C. Raceways shall be 600 volt rated, and be in compliance with the applicable paragraphs of NEC Article 352.
- D. They shall be non-flammable, and UL labeled, under UL 5, or UL 5A (as applicable).
- E. The completed raceway system shall be vandal resistant.
- F. The cover plates used for wiring devices and telecommunication outlets shall be of the 'overlapping' type, and shall therefore cover the 'cut-end' of the raceway cover.

## 2.3 BOXES

- A. Boxes for fixtures, outlets, switches, equipment connections and wire pulling shall be
  1. Cast or formed from carbon steel sheets of commercial grade steel not less than 14-gauge,
  2. One-piece construction, zinc, or cadmium plated,
  3. Tapped for mounting plates and covers as required.
- B. Pull and junction boxes shall be
  1. Fabricated from galvanized or painted code gauge cold rolled carbon steel sheets.
  2. Welded construction with flat removable covers fastened to the box with machine screws.
  3. Seams and joints shall be closed and reinforced with flanges formed of the same material from which the box is constructed or by continuous welding which will provide equivalent strength to flange construction.
  4. Preferably not provided with 'knockouts'.
- C. Box covers shall be fastened in place by machine screws or hinges and latches. Self-tapping or sheet metal fasteners are not acceptable.

## 2.4 SUPPORTS

- A. Hangers and brackets shall be made of steel pipe, channel iron, angle iron or prefabricated steel channel. Prefabricated steel channel shall be by B-Line, Hilti, Powerstrut, Unistrut or approved equal.
- B. Anchors shall be lead shield anchors or plastic expansion anchors for small loads, and expansion or epoxy anchors for large loads. Powder-driven anchors shall not be used.

## 2.5 LABELS AND DIRECTORIES

- A. Equipment nameplates shall be engraved .125 inch (1/8") thick lamacoid plastic. White, with black letters. The engraved letters shall be at least one quarter inch (1/4") high.
- B. Receptacles and lighting switches shall be labeled using clear adhesive backed nylon or Mylar tape with black text permanently laminated to the tape.
- C. Panel directories shall be typed on supplied card stock with panel, or card stock similar in thickness and material as those supplied with the panels. Install supplied clear plastic cover, or one of like material.

## PART 3 - EXECUTION

### 3.1 RACEWAYS

- A. Size conduits in accordance with the NEC, but not less than the sizes shown on the drawings. Minimum power and control conduit size shall be 1/2".
- B. All branch circuits and feeders require an equipment grounding conductor be run in each raceway.
- C. Install concealed and exposed conduits and cable trays parallel to or at right angles to building lines. Conduits shall not be embedded in concrete slabs except where specifically shown. Install surface raceways as close to room corners or trim features as possible to make the surface raceways less obvious.
- D. Make directional changes in primary power distribution conduits above ground with sweeps and long radius elbows, and underground with 20' minimum radius bends.
- E. Conceal conduits wherever possible and practical. When conduits cannot be concealed in finished areas, use surface raceways with matching boxes from the same manufacturer as the raceways.
- F. Metal conduits, fittings, enclosures and raceways shall be mechanically joined together in a firm assembly to form a continuous electrical conductor providing effective electrical grounding continuity.
- G. Provide expansion fittings at the intervals specified in the manufacturer's instructions.
- H. Conduits entering panels located outdoors, in parking structures, in steam tunnels and on cooling towers shall enter from the sides, back, or bottom. Conduits shall not enter from the top.
- I. Separate raceways from uninsulated steam pipes, hot water pipes, and other hot surfaces by a minimum of 4" horizontally or 12" vertically. Separate raceways from ventilation ducts and insulated pipes so that they do not come into contact with each other.
- J. EMT conduit shall be secured with locknut inside and set screw connector on outside. Sufficient thread on the connector or conduit shall extend into the enclosure so that the bushing will butt tight into the connector or conduit. Bushings shall not be used as jamb nuts or in lieu of locknuts.
- K. Flexible metallic conduit to motors and similar equipment shall not exceed 3'-0" in length, and shall have adequate slack to absorb the maximum vibration. Flexible conduit connections to lighting fixtures shall not exceed 6'-0" in length.

### 3.2 MOUNTING HEIGHTS

- A. Except where shown otherwise, install equipment and devices at the following heights:
  - 1. Receptacles (Wall): 18" A.F.F. to center
  - 2. Light Switches: 48" A.F.F. to center
  - 3. Thermostats/HVAC Controls: 48" A.F.F. to center

4. Electrical Panels: 72" A.F.F. to top
5. Safety Switches/Motor Starters/Variable Frequency Drives: 72" A.F.F. to top (except top of handle shall not exceed 78" A.F.F.)

### 3.3 SUPPORTS

- A. Support all electrical items independently of supports provided by the other trades.
- B. Support conduits and boxes using steel conduit straps or uni-strut. Suspended ceiling hangers or hanger wire shall not be used (except to support flexible metallic conduit and manufactured wiring systems).
- C. Hangers shall be of sufficient strength that their deflection at mid span does not exceed 1/240 of the hanger span length after the cables are installed.

### 3.4 PENETRATIONS, SLEEVES AND FIRE SEALS

- A. Cut floor and wall penetrations neatly and to the minimum size required for installation of the equipment and raceways.
- B. Provide galvanized steel pipe sleeves for all conduits penetrating floors, exterior walls and roofs.
  1. Extend floor sleeves above the floor a minimum of 2 inches.
  2. Seal exterior wall and roof penetrations water tight.
- C. Patch both sides of wall penetrations cut for electrical equipment and raceways to seal against the passage of air, sound and fire.
  1. Seal cable tray penetrations in fire rated walls using fire sealant bags approved by a Nationally Recognized Testing Laboratory.
  2. Seal conduit penetrations in fire rated walls using fire-sealing caulk approved by a Nationally Recognized Testing Laboratory.
  3. Seal conduit penetrations in non-rated walls using masonry materials that match the wall construction.
  4. Fire seal between recessed outlet boxes located on opposite sides of a fire rated wall if the box openings are over 16 square inches and the boxes are less than 24 inches apart.

### 3.5 EXPANSION FITTINGS

- A. Provide expansion fittings at all building expansion joints. Expansion fittings shall be bonded to the raceway on both sides.
- B. Provide expansion fittings, in accordance with manufacture recommendations, in all areas subject to swings in temperature of more than 15 degrees C.
- C. Install expansion fittings in all locations where expected expansion difference is ¼", or more, between boxes

### 3.6 IDENTIFICATION

- A. Provide nameplates and labels in accordance with Article 2.5.
  1. Lamacoid labels shall be mechanically secured in place with sheet metal screws and/or bolts and nuts
  2. Labels shall be neatly centered. Place labels in like positions on similar equipment.
- B. Color code wiring as noted in Section 26120

- C. Color code junction boxes and box covers of emergency and fire alarm circuits with red paint. Color code junction boxes and box covers of temperature control circuits with blue paint.
- D. Mark junction box covers in indelible ink with the panel and breaker numbers of the circuits contained within.
- E. Provide a 3" by 5" yellow "Warning Arc Flash Hazard" label on the outside of panels in 'occupant areas' - Brady Type 99454 or equivalent from another manufacturer. Center the label horizontally and vertically on outside of door.
- F. Provide a 4" by 6" red "Danger Arc Flash and Shock Hazard" label on the outside of panels in areas open only to 'qualified personnel', and on the inside panel door of panels in 'occupant areas' - Brady Type 99459. Center label on gutter areas of distribution panels, centered above or below the directory of panels, and otherwise centered in other applications. In all cases, label will be no lower than 48" or above 84" AFF

END OF SECTION