

# JOINT HEALTH SCIENCES CENTER - CAFÉ FITOUT

Camden, New Jersey

PREPARED FOR  
**Rowan University – Rutgers Camden**  
**Board of Governors**  
Joint Health Sciences Center  
201 Broadway, Suite 400  
Camden, New Jersey 08103

Architect  
Hellmuth, Obata + Kassabaum, Inc.  
1065 Avenue of the America, 6<sup>th</sup> Floor  
New York, NY 10018

Architect of Record  
Joseph F. McKernan, Jr. Architects & Associates, LLC  
100 Dobbs Lane, Suite 204  
Cherry Hill, NJ 08034

**Issued for Construction**  
**January 17, 2020**

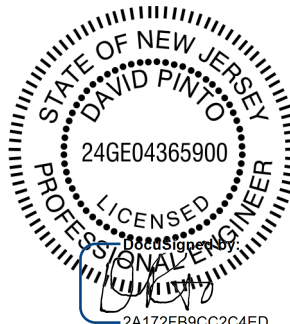
DS



DocuSigned by:

*Joseph F. McKernan Jr.*

51931604E0BD408...



2A172FB9CC2C4ED...

**TABLE OF CONTENTS**

**DIVISION 0 – BIDDING REQUIREMENTS**

Specification Data Sheet.....1-2  
Notice to Bidders.....1-2  
Project Labor Agreement .....1-36  
Bid Document Submission Checklist .....1-2  
    Non-Collusion Affidavit.....1  
    Bid Bond .....1  
    Consent of Surety .....1  
    Equipment Certification Form.....1  
    Subcontractor Identification Statement .....1-2  
    Disclosure of Investment Activities in Iran.....1  
    Total Amount of Uncompleted Contracts .....1  
State Treasurer’s List of Debarred, Suspended and Disqualified Bidders.....1-2  
Political Contributions Disclosure Form .....1  
002113 Instructions to Bidders.....1-13  
004113 Form of Proposal .....1-3  
004518 Hold Harmless Clause .....1  
004520 No Material Change of Circumstances.....1  
004543 Statement of Corporate Ownership Disclosure.....1-3  
004546 Contractor Business Registration Certificate.....1-2  
004548 Public Works Contractor Registration Act .....1  
006239 Affirmative Action Regulations and Mandatory Equal Employment Opportunity Language.....1-5  
007340 Wage and Hour Compliance.....1-2  
007343 Prevailing Wage Compliance Declaration.....1  
Consent of Surety (AIA-G 707) .....1  
Standard Form of Agreement Between Owner and Contractor (AIA-A132).....1-11  
General Conditions of the Contract for Construction (AIA-A232).....1-42  
Release of Liens (AIA-G 706A).....1

**DIVISION 01 – GENERAL REQUIREMENTS**

Section 011100 Summary .....1  
Section 012100 Allowances.....1-2  
Section 012500 Substitution Procedures.....1-2  
Section 012600 Contract Modification Procedures.....1-2  
Section 012900 Payment Procedures .....1-4  
Section 013100 Project Management and Coordination.....1-5  
Section 013200 Construction Progress Documentation.....1-5  
Section 013233 Photographic Documentation .....1-2  
Section 013300 Submittal Procedures.....1-8  
Section 014000 Quality Requirements.....1-2  
Section 015000 Temporary Facilities and Controls .....1-4  
Section 016000 Product Requirements .....1-2  
Section 017300 Execution.....1-10  
Section 017400 Warranties .....1-2  
Section 017700 Close-out Procedures.....1-5  
Section 017823 Operation and Maintenance Data .....1-7  
Section 017839 Project Record Documents.....1-4  
Section 017900 Demonstration and Training.....1-6

**DIVISION 09 – FINISHES**

Section 092900 Gypsum Board.....1-7  
Section 093013 Ceramic Tiling.....1-7  
Section 095113 Acoustical Panel Ceilings.....1-7  
Section 099100 Painting .....1-6

**DIVISION 10 – SPECIALTIES**

Section 102600 Wall and Door Protection.....1-4

**DIVISION 20 – RESERVED**

Section 200000 Common Mechanical/Electrical Requirements .....1-23

**DIVISION 21 - FIRE SUPPRESSION**

Section 210500 Common Work Results for Fire Suppression.....1-13  
Section 210553 Identification for Fire-Suppression Piping and Equipment .....1-5  
Section 211313 Wet-Pipe Sprinkler Systems.....1-13

**DIVISION 22 – PLUMBING**

Section 220500 Common Work Results for Plumbing .....1-8  
Section 220517 Sleeves and Sleeve Seals for Plumbing Piping .....1-13  
Section 220518 Escutcheons for Plumbing Piping .....1-2  
Section 220529 Hangers and Supports for Plumbing Piping and Equipment .....1-13  
Section 220553 Identification for Plumbing Piping and Equipment.....1-8  
Section 220719 Plumbing Piping Insulation .....1-15  
Section 221110 Common Plumbing Piping .....1-28  
Section 221119 Water Piping Specialties .....1-7

**DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

Section 230500 Common Work Results for HVAC .....1-17  
Section 230517 Sleeves and Sleeve Seals for HVAC Piping.....1-5  
Section 230518 Escutcheons for HVAC Piping.....1-2  
Section 230523 General-Duty Valves for HVAC Piping.....1-14  
Section 230529 Hangers and Supports for HVAC Piping and Equipment .....1-12  
Section 230548 Vibration Controls for HVAC .....1-14  
Section 230553 Identification for HVAC Piping and Equipment .....1-7  
Section 230593 Testing, Adjusting and Balancing for HVAC .....1-19  
Section 230713 Duct Insulation .....1-20  
Section 230719 HVAC Piping Insulation .....1-16  
Section 230800 Mechanical Systems Commissioning.....1-7  
Section 230900 Instrumentation and Control for HVAC.....1-20  
Section 232113 Hydronic Piping .....1-11  
Section 233113 Metal Ducts .....1-10  
Section 233300 Air Duct Accessories.....1-15  
Section 233713 Diffusers, Registers and Grilles.....1-6  
Section 238216 Air Coils .....1-4

**DIVISION 26 – ELECTRICAL**

Section 260500 Common Work Results for Electrical .....1-11  
Section 260519 Low-Voltage Conductors and Cables.....1-8  
Section 260526 Grounding and Bonding for Electrical Systems .....1-8  
Section 260529 Hangers and Supports for Electrical Systems.....1-5  
Section 260533 Raceway and Boxes for Electrical Systems .....1-9  
Section 260548 Vibration Controls for Electrical Systems.....1-5  
Section 260553 Identification for Electrical Systems .....1-7  
Section 260923 Lighting Control Devices .....1-6  
Section 260943 Networked Lighting Control System.....1-23  
Section 262726 Wiring Devices.....1-7  
Section 262813 Fuses.....1-4  
Section 262816 Enclosed Switches and Circuit Breakers .....1-6  
Section 262913 Enclosed Controllers .....1-10  
Section 265100 Interior Lighting .....1-13

**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

Section 283105	Fire Alarm Cables and Pathways .....	1-5
Section 283111	Digital, Addressable Fire-Alarm System.....	1-23

**END OF TABLE OF CONTENTS**



## SPECIFICATION DATA SHEET

### **Project:**

Name: Joint Health Sciences Center – Café Fitout  
Location: 201 South Broadway, Camden, New Jersey 08103  
Project No.: HOK No. 16.07011.00

### **Owner:**

Name: Rowan University – Rutgers Camden Board of Governors  
Address: 201 S. Broadway, Suite 440, Camden, New Jersey 08103  
Representative: Mr. Dean D’Astuto  
Phone: (856)-203-6757 Fax: (856)-379-3953  
E-mail: [ddastuto@rurcbog.com](mailto:ddastuto@rurcbog.com)

### **Construction Manager:**

Name: STV Inc  
Address: 1818 Market Street, Suite 2300, Philadelphia, PA 19103  
Representative: Mr. Dennis Hayes  
Phone: (215)-779-0789 Fax: (215)-832-3599  
E-mail: [dennis.hayes@stvinc.com](mailto:dennis.hayes@stvinc.com)

### **Architect:**

Name: Hellmuth, Obata & Kassabaum, P.C.  
Address: One Logan Square, Suite 1510, Philadelphia, PA 19103  
Representative: Maria Papacharalambous  
Phone: (215) 940-3727 Fax: (215) 940-3571  
E-mail: [maria.papacharalambous@hok.com](mailto:maria.papacharalambous@hok.com)

### **Architect of Record:**

Name: Joseph F. McKernan Jr., Architect & Associates  
Address: 100 Dobbs Lane, Suite 204, Cherry Hill, New Jersey 08034  
Representative: John McQuilkin, AIA  
Phone: (856) 616-2960 Fax: (856) 616-2963  
E-mail: [john@mckernanarchitects.com](mailto:john@mckernanarchitects.com)

**Mechanical, Plumbing, and Electrical Engineering & IT/Security:**

Name: R. G. Vanderweil Engineers, LLP  
Address: 101 Grovers Mill Road, Lawrenceville, New Jersey 08648  
Represent.: Robert Zachowski  
Phone: (609) 786-2723 Fax: (609) 987-9297  
E-mail: rzachowski@Vanderweil.com

**ROWAN UNIVERSITY/RUTGERS – CAMDEN BOARD OF GOVERNORS  
JOINT HEALTH SCIENCES CENTER CAFÉ FITOUT PROJECT  
NOTICE TO BIDDERS**

Notice is hereby given that sealed bids will be received by the Rowan University/Rutgers – Camden Board of Governors on April 7, 2020 at 3:00 P.M., Local Time at the Rowan University / Rutgers-Camden Board of Governors, located at 201 S Broadway, Suite 440, Camden, New Jersey 08103, at which time and place bids will be publicly opened and immediately read for:

**JOINT HEALTH SCIENCES CENTER-CAFÉ FITOUT  
Contract #1 – General Construction**

Specifications, instructions to bidders and proposal forms may be obtained at the office of the Rowan University / Rutgers-Camden Board of Governors; upon a non-refundable payment of \$50.00 for a disk (Bidders are responsible for the cost of all reproductions). Payments (non-refundable) should be made via company check, certified check or money order, made payable to the Rowan University / Rutgers-Camden Board of Governors. Plans and specifications will be available beginning on Monday, March 9, 2020. Bids will be made on the proposal form provided, in the manner designated therein and required in the specifications, enclosed in an opaque sealed envelope and plainly marked on the outside with the date, time and Contract being bid.

Each proposal must be accompanied by a Certified Check, Cashier's Check, or Bid Bond for not less than 10 percent (10%) of the total amount bid, but not in excess of \$20,000, made payable to Rowan University / Rutgers-Camden Board of Governors. Successful bidder will be required to furnish a bond of a surety company, satisfactory to the Rowan University / Rutgers-Camden Board of Governors, in a sum equal to 100% of the total contract price.

A non-mandatory pre-bid meeting will be held on March 18, 2020 at 10:00 A.M. Local Time at the Rowan University / Rutgers-Camden Board of Governors, located at 201 S Broadway, Camden, New Jersey 08103. All potential bidders are strongly encouraged to attend. The Owner reserves the right to schedule additional meetings if it is in the best interest of the project.

This project shall be bid as a single bid (lump sum all trades). Bidders must be prequalified by the New Jersey Division of Property Management and Construction (NJDPMC) for Classification C006 – Construction Manager as Constructor or C008 – General Construction. Bidders must be classified themselves or have their classified subcontractor(s) for the following trade(s): Plumbing (C030), HVACR (CO32), Electrical (C047).

\*Note: If the HVAC Contractor or Subcontractor has applied for the new, state-required, HVACR license, but has yet to receive same, and therefore has yet have its DPMC classification changed from CO39 (HVAC) to CO32 (HVACR), it must provide proof of filing (1) an application with the State for the HVACR license; (2) proof that it has notified the DPMC of this pending application; and (3) proof of its current CO39 CPMC classification.

Prospective bidders are advised that the Project is subject to a Project Labor Agreement (“PLA”). The PLA will be binding upon the successful bidder, and its subcontractors (as applicable). A copy of the PLA is included in the Project Specifications.

All bidders are required to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 (Equal Employment Opportunity and Affirmative Action), P.L. 1963, C. 150 (New Jersey Prevailing Wage Act), and Americans with Disabilities Act of 1990 (42 U.S.C. 12101, et.

Seq.). All bidders are further notified that they must comply with P.L. 1977, C. 33 and submit a Disclosure Statement listing stockholders with the bid. In addition all bidders must comply with P.L. 1999, c. 238 – Public Works Contractor Registration Act and the contractor and all subcontractors must be registered in accordance with the Act.

The Owner reserves the right to reject any or all bids, to waive any informalities, deviations, or omissions in any bid or all bids, and to accept such bids and make such awards as may be in the best interest of the Owner and pursuant to applicable law. Furthermore, the Owner may request written clarification of any aspect of the proposal where, in the Owner's opinion, ambiguities exist. No bidder may withdraw its bid for a period of sixty (60) days after the actual date of the opening of the bids.

By the Order of

DANA REDD, CEO

CAMDEN COUNTY

PROJECT LABOR AGREEMENT

FOR

CAMDEN COUNTY IMPROVEMENT AUTHORITY

ROWAN/RUTGERS  
JOINT HEALTH SCIENCES CENTER  
CAFE FITOUT  
2020

## PROJECT LABOR AGREEMENT

This Agreement made this \_\_\_\_ day of \_\_\_\_\_, 2017, by and among the Rowan University/Rutgers-Camden Board of Governors (the "Board" or "Owner"; \_\_\_\_\_, (the "Contractor"); The United Building Trades Council of Southern New Jersey, AFL-CIO (the "Trades Council"); The Unions listed on the signatory pages of this Agreement (the Local Unions"); and the Camden County Improvement Authority, (the "Project Manager") hereby recites as follows:

### ARTICLE 1 – PREAMBLE

WHEREAS, the Board, as Owner, desires to provide for the efficient, safe, quality, and timely completion of a comprehensive construction program of activities associated with the construction of a Joint Health Sciences Center located in Camden City, comprised of a bid for pile foundations and construction of a building, collectively known as the "Joint Health Sciences Center Project" (the "Project"). The "Project", which will be undertaken in phases, in a manner designed to afford lower reasonable costs to the Owner, and the public it represents, and the advancement of public policy objectives; and

WHEREAS, this Project Labor Agreement, authorized by resolution of the Camden County Improvement Authority on February 9, 2017, pursuant to N.J.S.A. 52:38-1 et seq., will foster the achievement of the aforementioned goals, among others, by:

- (1) Ensuring a reliable source of skilled and experienced labor;
- (2) Standardizing the terms and conditions governing the employment of labor on the Project;
- (3) Permitting wide flexibility in work scheduling and shift hours and times from those which otherwise might obtain;
- (4) Receiving negotiated adjustments as to work rules and staffing requirements from those which otherwise might obtain;
- (5) Providing comprehensive and standardized mechanisms for the settlement of work disputes, including those relating to jurisdiction;

- (6) Avoiding the costly delays of potential strikes, slowdowns, walkouts, picketing and other disruptions arising from work disputes, and promote labor harmony and peace for the duration of the project.
- (7) Furthering public policy objectives as to improved employment opportunities for minorities, women and the economically disadvantaged in the construction industry; and
- (8) Expediting the construction process; and

WHEREAS, the signatory Unions desire the stability, security and work opportunities afforded by a Project Labor Agreement; and

WHEREAS, the Parties desire to maximize Project safety conditions for both workers and the public;

NOW, THEREFORE, the Parties enter in to this Agreement:

## SECTION 1. PARTIES TO THE AGREEMENT

This is a Project Labor Agreement ("Agreement") entered in to by and among the Board and its successors and assigns; the Contractor to be named, for certain construction work to be performed on the Project; by the Trades Council on behalf of itself and its affiliates and members; the Local Unions, and the Project Manager (the Authority).

## ARTICLE 2 - GENERAL CONDITIONS

### SECTION 1. DEFINITIONS

Throughout this Agreement, the Union parties and the Trades Council are referred to singularly and collectively as "the Union(s)," and where specific reference is made to "Local Unions" that phrase is sometimes used; the term "Contractor(s)" shall include the signatory contractor, and its subcontractors of whatever tier, engaged in on-site Project construction work within the scope of this Agreement as defined in Article 3; the Rowan University/Rutgers-Camden is referenced as the "Board" or "Owner"; The "United Building Trades Council of

Southern New Jersey, AFL-CIO" is referenced as the "Trades Council"; the Camden County Improvement Authority, the Project Manager, is referenced as "PM"; and the work covered by this Agreement (as defined in Article 3) is referred to as the "Project".

## **SECTION 2. CONDITIONS FOR AGREEMENT TO BECOME EFFECTIVE**

The Agreement shall not become effective unless executed by all parties designated in Article 1, Section 1 above, and shall remain in effect until the completion of the Project.

## **SECTION 3. ENTITIES BOUND & ADMINISTRATION OF AGREEMENT**

This Agreement shall be binding on all signatory Unions and the Project Manager and all signatory Contractors performing on-site Project work, including site preparation and staging areas, as defined in Article 3. The Contractors shall include in any subcontract that they let, for performance during the term of this Agreement, a requirement that their subcontractors, of whatever tier, become signatories and bound by this Agreement with respect to subcontracted work performed within the scope of Article 3. This Agreement shall be administered by the PM on behalf of all Contractors.

## **SECTION 4. SUPREMACY CLAUSE**

This Agreement, together with the local Collective Bargaining Agreements appended hereto as Schedule A, represents the complete understanding of all signatories and supersedes any national agreement, local agreement or other collective bargaining agreement of any type which would otherwise apply to this Project, in whole or in part. Where a subject covered by the provisions, explicit or implicit, of this Agreement is also covered by a Schedule A, the provisions of this Agreement shall prevail. It is further understood that neither the PM nor any Contractor shall be required to sign any other agreement as a condition of performing work on this Project. No practice, understanding or agreement between a Contractor and Local Union, which is not explicitly set forth in this Agreement shall be binding on this Project unless endorsed in writing by the PM.



## **SECTION 5. LIABILITY**

The liability of any Contractor and the liability of any Union under this Agreement shall be several and not joint. The PM and any Contractor shall not be liable for any violations of this Agreement by any other Contractor and the Trades Council and Local Unions shall not be liable for any violations of this Agreement by any other Union.

## **SECTION 6. NATURE OF AGREEMENT**

The Owner shall require in its bid specifications for all work within the scope of Article 3 that all successful bidders, and their subcontractors of whatever tier, become bound by, and signatory to, this Agreement. The Owner shall not be bound by the terms of this Agreement as may apply between the Contractor, and the Trades Council or any of the Local Unions, nor shall the Owner be liable for any breach thereof. It is understood that nothing in this Agreement shall be construed as limiting the sole discretion of the Owner in determining which Contractors shall be awarded contracts for Project work. It is further understood that the Owner has sole discretion at any time to terminate, delay or suspend the work, in whole or part, on this Project.

## **SECTION 7. AVAILABILITY AND APPLICABILITY TO ALL SUCCESSFUL BIDDERS**

The Unions agree that this Agreement will be made available to, and will fully apply to any successful bidder for Project work who becomes signatory thereto, without regard to whether that successful bidder performs work at other sites on either a union or non-union basis and without regard to whether employees of such successful bidder are, or are not, members of any unions. This Agreement shall not apply to the work of any Contractor or PM, which is performed at any location other than the Project site, as defined in Article 3, Section 1.

## **ARTICLE 3 - SCOPE OF THE AGREEMENT**

The Project work covered by this Agreement shall be as defined and limited by the following sections of this Article.

## SECTION 1: THE WORK

This Agreement shall apply to the Project. The scope of work is confined to the on-site Project work contained in the scope of the Contractor's final construction contract.

## SECTION 2. EXCLUDED EMPLOYEES

The following persons are not subject to the provisions of this Agreement, even though performing work on the Project:

- a. Superintendents, supervisors (excluding superintendents and general supervisors and forepersons specifically covered by a craft's Schedule A), engineers, inspectors and testers (excluding divers specifically covered by a craft's Schedule A), quality control/assurance personnel, timekeepers, mail carriers, clerks, office workers, messengers, guards, non-manual employees, and all professional, engineering, administrative and management persons;
- b. Employees of Owner or any State agency, authority or entity or employees of any municipality or other public employer;
- c. Employees and entities engaged in off-site manufacture, modifications, repair, maintenance, assembly, painting, handling or fabrication of project components, materials, equipment or machinery, unless such offsite operations are covered by the New Jersey Prevailing Wage Act by being dedicated exclusively to the performance of the public works contract or building project and are adjacent to the site of work, or involved in deliveries to and from the Project site, excepting local deliveries of all major construction materials including but not limited to fill, ready mix, asphalt, etc.
- d. Employees of the PM or Contractor, excepting those performing manual, on-site construction labor who will be covered by this Agreement;
- e. Employees engaged in on-site equipment warranty.
- f. Employees engaged in geophysical testing (whether land or water) other than boring for core samples;
- g. Employees engaged in laboratory or specialty testing or inspections;
- h. Employees engaged in ancillary Project work performed by third parties such as electric utilities, gas utilities, telephone utility companies, and railroads.

### SECTION 3. NON-APPLICATION TO CERTAIN ENTITIES

This Agreement shall not apply to the parents, affiliates, subsidiaries, or other joint or sole ventures of any Contractor or of PM, who do not perform work at the Project. It is agreed, for the purposes of this Agreement only, that this Agreement does not have the effect of creating any joint employment, single employer or *alter ego* status among the Owner, the PM and/or any Contractor. Further, this Agreement shall not apply to the Owner or any other state or county agency, authority, or other municipal or public entity and nothing contained herein shall be construed to prohibit or restrict the Owner or its employees of any other state authority, agency or entity and its employees from performing on or off-site work related to the Project. As the contracts which comprise the Project work are completed and accepted, the Agreement shall not have further force or effect on such items or areas except where inspections, additions, repairs, modifications, check-out and/or warranty work are assigned in writing (copy to Local Union involved) by the Contractor for performance under the terms of this Agreement.

### ARTICLE 4 - UNION RECOGNITION AND EMPLOYMENT

#### SECTION 1. PRE-HIRE RECOGNITION

The Contractors recognize the signatory Unions as the sole and exclusive bargaining representatives of all craft employees who are performing on-site Project work within the scope of this Agreement as defined in Article 3.

#### SECTION 2. UNION REFERRAL

A. The Contractors agree to hire Project craft employees covered by this Agreement through the job referral systems and hiring halls (where the referrals meet the qualifications set forth in items 1, 2, and 4 subparagraph B) established in the Local Unions' area collective bargaining agreements (attached as Schedule A to this Agreement). Notwithstanding this, the Contractors shall have sole rights to determine the competency of all referrals; the number of employees required \_\_\_\_\_; the selection of employees to be laid-off (subject to the applicable procedures in Schedule A for permanent and/or temporary layoffs and except as provided in Article 5, Section 3); and the sole right to reject any applicant

referred by a Local Union, subject to the show-up payments required in the applicable Schedule A. In the event that a Local Union is unable to fill any request for qualified employees within a 48-hour period after such requisition is made by the Contractor (Saturdays, Sundays, and holidays excepted), the Contractor may employ qualified applicants from another competent source. In the event that the Local Union does not have a job referral system, the Contractor shall give the Local Union first preference to refer applicants, subject to the other provisions of this Article. The Contractor shall notify the Local Union of the Project, craft employees hired within its jurisdiction from any source other than referral by the Union.

B. A Contractor may request by name, and the Local will honor, referral of persons who have applied to the Local for Project work and who meet the following qualifications as determined by a Committee of 3 designated, respectively, by the applicable Local Union, the PM and a mutually selected third party or, in the absence of agreement, the permanent arbitrator (or designee) designated in Article 7:

- (1) Possess any license required by NJ law for the Project work to be performed;
- (2) Have worked a total of at least 1000 hours in the Construction craft during the prior 3 years;
- (3) Were on the Contractor's active payroll for at least 60 out of the 180 calendar days prior to the contract award;
- (4) Have demonstrated ability to safely perform the basic function of the applicable trade.

No more than 12 per centum of the employees covered by this Agreement, per Contractor by craft, shall be hired through the special provisions above (any fraction shall be rounded to the next highest whole number).

C. A certified MBE/WBE contractor may request from the Workforce Coordinator, through the PM, an exception to, and waiver of, the above per centum limitation upon the number of its employees to be hired through the special provision of Section 2.B above. This exception is based upon hardship and demonstration by the contractor that the Project work would be the Contractor's only job and that it would be obliged to lay off qualified minority and

female employees in its current workforce moving from the last job. The exception and waiver are also conditioned upon the employees meeting the qualifications as set forth in Section 2.B, above.

### **SECTION 3. NON-DISCRIMINATION IN REFERRALS**

The Unions represent that their hiring halls and referral systems will be operated in a non-discriminatory manner and in full compliance with all applicable federal, state and local laws and regulations, which require equal employment opportunities. Referrals shall not be affected in any way by the rules, regulations, bylaws, constitutional provisions or any other aspects or obligations of union membership, policies or requirements and shall be subject to such other conditions as are established in this Article. No employment applicant shall be discriminated against by any referral system or hiring hall because of the applicant's union membership, or lack thereof.

### **SECTION 4. MINORITY AND FEMALE REFERRALS**

In the event a Union either fails, or is unable, to refer qualified minority or female applicants in percentages equaling Project affirmative action goals as set forth in the Owner's bid specifications, the Contractor may employ qualified minority or female applicants from any other available source as Apprentice Equivalents. Apprentice Equivalents will have completed a DOL approved training program, applied to take a construction Apprenticeship test, and will be paid at not less than the applicable equivalent Apprentice rate. With the approval of the Local Administrative Committee (LAC), experience in construction related areas may be accepted as meeting the above requirements.

### **SECTION 5. CROSS AND QUALIFIED REFERRALS**

The Unions shall not knowingly refer to a Contractor an employee then employed by another Contractor working under this Agreement. The Local Unions will exert their utmost efforts to recruit sufficient numbers of skilled and qualified craft employees to fulfill the requirements of the Contractor.

## **SECTION 6. UNION DUES / WORKING ASSESSMENTS**

All employees covered by this Agreement shall be subject to the union security provisions contained in the applicable Schedule A local agreements, as amended from time to time, but only for the period of time during which they are performing on-site Project work and only to the extent of rendering payment of the applicable union dues and assessments uniformly required for union membership in the Local Union, signatory to this Agreement, which represents the craft in which the employee is performing Project work. No employee shall be discriminated against at the Project site because of the employee's union membership or lack thereof. In the case of unaffiliated employees, the dues payment can be received by the Unions as a working assessment fee.

## **SECTION 7. CRAFT FOREPERSONS AND GENERAL FOREPERSONS**

The selection of craft forepersons and/or general forepersons and the number of forepersons required shall be solely the responsibility of the Contractor except where otherwise provided by specific provisions of an applicable Schedule A. All forepersons shall take orders exclusively from the designated Contractor representatives. Craft forepersons shall be designated as working forepersons at the request of the Contractor, except when an existing local Collective Bargaining Agreement prohibits a foreperson from working when the craftspersons he is leading exceed a specified number.

## **ARTICLE 5 - UNION REPRESENTATION**

### **SECTION 1. LOCAL UNION REPRESENTATIVE**

Each Local Union representing on-site Project employees shall be entitled to designate in writing (with copies to the Contractor and PM) one representative, and the Business Manager, who shall be afforded access to the Project.

### **SECTION 2. STEWARDS**

(a) Each Local Union shall have the right to designate a working journey person as a Steward and an alternate, and shall notify the Contractor and PM of the identity of the

designated Steward (and alternate) prior to the assumption of such duties. Stewards shall not exercise supervisory functions and will receive the regular rate of pay for their craft classifications. There will be no non-working Stewards on the Project.

(b) In addition to their work as an employee, the Steward shall have the right to receive complaints or grievances and to discuss and assist in their adjustment with the Contractor's appropriate supervisor. Each Steward shall be concerned with the employees of the Steward's Contractor and, if applicable, subcontractors of that Contractor, but not with the employees of any other Contractor. The Contractor will not discriminate against the Steward in the proper performance of Union duties.

(c) The Stewards shall not have the right to determine when overtime shall be worked, or who shall work overtime, except pursuant to a Schedule A provision providing procedures for the equitable distribution of overtime.

### **SECTION 3. LAYOFF OF A STEWARD**

Contractors agree to notify the appropriate Union 24 hours prior to the layoff of a Steward, except in cases of discipline or discharge for just cause. If a Steward is protected against layoff by a Schedule A, such provisions shall be recognized to the extent the Steward possesses the necessary qualifications to perform the work required. In any case in which a Steward is discharged or disciplined for just cause, the Local Union involved shall be notified immediately by the Contractor.

## **ARTICLE 6 - MANAGEMENT'S RIGHTS**

### **SECTION 1. RESERVATION OF RIGHTS**

Except as expressly limited by a specific provision of this Agreement, Contractors retain full and exclusive authority for the management of their Project operations including, but not limited to the right to direct the work force, including determination as to the number to be hired and the qualifications therefore; the promotion, transfer, layoff of its employees; or the discipline or discharge for just cause of its employees; the assignment and schedule of work; the

promulgation of reasonable Project work rules; and, the requirement, timing and number of employees to be utilized for overtime work. No rules, customs, or practices, which limit or restrict productivity or efficiency of the individual, as determined by the Contractor or PM, and/or joint working efforts with other employees shall be permitted or observed.

## **SECTION 2. MATERIALS, METHODS & EQUIPMENT**

There shall be no limitations or restriction upon the contractors' choice of materials, techniques, methods, technology or design, or, regardless of source or location, upon the use and installation of equipment, machinery, package units, pre-cast, pre-fabricated, pre-finished, or pre-assembled materials, tool, or other labor-saving devices. Contractors may, without restriction, install or use materials, supplies or equipment regardless of their source. The on-site installation or application of such items shall be performed by the craft having jurisdiction over such work; provided, however, it is recognized that other personnel having special qualifications may participate, in a supervisory capacity, in the installation, check-out or testing of specialized or unusual equipment or facilities as designated by the Contractor. Notwithstanding the foregoing statement of contractor rights, prefabrication issues relating to work traditionally performed at the job site shall be governed pursuant to the terms of the applicable Schedule A. There shall be no restrictions as to work, which is performed off-site for the Project, except for work done in a fabrication center, tool yard, or batch plant dedicated exclusively to the performance of work on the Project, and located adjacent to the "site of work".

## **ARTICLE 7 - WORK STOPPAGES AND LOCKOUTS**

### **SECTION 1. NO STRIKES-NO LOCKOUT**

There shall not be strikes, sympathy strikes, picketing, work stoppages, slowdowns, hand billing, demonstrations or other disruptive activity at the Project for any reason by any Union or employee against any Contractor or employer while performing work at the Project. There shall be no other Union, or concerted or employee activity which disrupts or interferes with the operation of the existing free flow of traffic in the project area. Failure of any Union or employee to cross any picket line established by any union, signatory or non-signatory to this Agreement, or the picket or demonstration line of any other organization, at or in proximity to the Project site is a



violation of this Article. There shall be no lockout at the Project by any signatory Contractor. Contractors and Unions shall take all steps necessary to ensure compliance with this Section 1 and to ensure uninterrupted construction and the free flow of traffic in the project area for the duration of this Agreement.

## **SECTION 2. DISCHARGE FOR VIOLATION**

A Contractor may discharge any employee violating Section 1, above, and any such employee will not be eligible thereafter for referral under this Agreement for a period of 100 days.

## **SECTION 3. NOTIFICATION**

If a Contractor contends that any Union has violated this Article, it will notify the appropriate district or area council of the Local Union involved advising of such fact, with copies of the notification to the Local Union and the Trades Council. The district or area council, and the Trades Council shall each instruct, order and otherwise use their best efforts to cause the employees, and/or the Local Unions to immediately cease and desist from any violation of this Article. A district or area council, or the Trades Council complying with these obligations shall not be liable for the unauthorized acts of a Local Union or its members.

## **SECTION 4. EXPEDITED ARBITRATION**

Any Contractor or Union alleging a violation of Section 1 of this Article may utilize the expedited procedure set forth below (in lieu of, or in addition to, any actions at law or equity) that may be brought.

- a. A party invoking this procedure shall notify J. J. Pierson, Jr., Esq., who shall serve as Arbitrator under this expedited arbitration procedure. Copies of such notification will be simultaneously sent to the alleged violator and, if a Local Union is alleged to be in violation, its International, the Owner, the Project Manager, the Trades Council, and the Contractor.

- b. The Arbitrator shall thereupon, after notice as to time and place to the Contractor, the Local Union involved, the Trades Council, and the Project Manager, hold a hearing within 48 hours of receipt of the notice invoking the procedure it is contended that the violation still exists. The hearing will not, however, be scheduled for less than 24 hours after the notice to the district or area council required by Section 3 above.
  
- c. All notices pursuant to this Article may be by telephone, telegraph, hand delivery, or fax, confirmed by overnight delivery, to the arbitrator, Contractor or Union involved. The hearing may be held on any day including Saturdays or Sundays. The hearing shall be completed in one session, which shall not exceed 8 hours duration (no more than 4 hours being allowed to either side to present their case, and conduct their cross examination) unless otherwise agreed. A failure of any Union or Contractor to attend the hearing shall not delay the hearing of evidence by those present or the issuance of an award by the Arbitrator.
  
- d. The sole issue at the hearing shall be whether a violation of Section 1, above occurred. If a violation is found to have occurred, the Arbitrator shall issue a Cease and Desist Award restraining such violation and serve copies on the Contractor and Union involved. The Arbitrator shall have no authority to consider any matter in justification, explanation or mitigation of such violation or to award damages, which issue is reserved solely for court proceedings, if any. The Award shall be issued in writing within 3 hours after the close of the hearing, and may be issued without an Opinion. If any involved party desires an Opinion, one shall be issued within 15 calendar days, but its issuance shall not delay compliance with, or enforcement of, the Award.
  
- e. An Award issued under this procedure may be enforced by any court of competent jurisdiction upon the filing of the Agreement together with the

Award. Notice of the filing of such enforcement proceedings shall be given to the Union or Contractor involved. In any court proceeding to obtain a temporary or preliminary order enforcing the arbitrator's Award as issued under this expedited procedure, the involved Union and Contractor waive their right to a hearing and agree that such proceedings may be *ex parte*, provided notice is given to opposing counsel. Such agreement does not waive any party's right to participate in a hearing for a final court order of enforcement or in any contempt proceeding.

- f. Any rights created by statute or law governing arbitration proceedings which are inconsistent with the procedure set forth in this Article, or which interfere with compliance thereto, are hereby waived by the Contractors and Unions to whom they accrue.
- g. The fees and expenses of the Arbitrator shall be equally divided between the involved Contractor and Union.

## **SECTION 5. ARBITRATION OF DISCHARGES FOR VIOLATION**

Procedures contained in Article 9 shall not be applicable to any alleged violation of this Article, with the single exception that an employee discharged for violation of Section 1, above, may have recourse to the procedures of Article 9 to determine only if the employee did, in fact, violate the provisions of Section 1 of this Article; but not for the purpose of modifying the discipline imposed where a violation is found to have occurred.

## **ARTICLE 8. - LOCAL ADMINISTRATIVE COMMITTEE (LAC)**

### **SECTION 1. THE LOCAL ADMINISTRATIVE COMMITTEE**

1) The local Administrative Committee will meet on a regular basis to implement and oversee this Agreement's procedures and initiatives; monitor the effectiveness of this Agreement; and identify opportunities to improve efficiency and work execution.

## SECTION 2. COMPOSITION

The LAC will be co-chaired by the President of the Trades Council or his designee, and a designated official of the Owner. It will be comprised of representatives of the local unions signatory to this Agreement and representatives of the PM and other contractors on the Project.

## ARTICLE 9 - GRIEVANCE & ARBITRATION PROCEDURE

### SECTION 1. PROCEDURE FOR RESOLUTION OF GRIEVANCES

Any question, dispute or claim arising out of, or involving the interpretation or application of this Agreement (other than jurisdictional disputes or alleged violations of Article 7, Section 1) shall be considered a grievance and shall be resolved only in the manner described below; provided, in all cases, that the question, dispute or claim arose during the term of this Agreement.

#### Step 1:

(a) When any employee covered by this Agreement feels aggrieved by a claimed violation of this Agreement, the employee shall, through the Local Union business representative or job steward give notice of the claimed violation to the work site representative of the involved Contractor(s). To be timely, such notice of the grievance must be given within 7 calendar days after the act, occurrence, or event giving rise to the grievance, or after the act, occurrence or event became known or should have become known to the Union. The business representative of the Local Union or the job steward and the work site representative of the involved Contractor(s) shall meet and endeavor to adjust the matter within 7 calendar days after timely notice has been given. If they fail to resolve the matter within the prescribed period, the grieving party, may, within 7 calendar days thereafter, pursue Step 2 of the grievance procedure by serving the involved Contractor(s) with written copies of the grievance setting forth a description of the claimed violation, the date on which the grievance occurred, the provisions of the Agreement alleged to have been violated. Grievances and disputes settled at Step 1 are non-precedential except as to the specific Local Union, employee and Contractor(s) directly involved, unless the settlement is accepted in writing, by the Contractor(s), as creating a precedent.

(b) Should any signatory to this Agreement have a dispute (excepting jurisdictional disputes or alleged violations of Article 7, Section 1) with any other signatory to this Agreement and, if after conferring, a settlement is not reached within 7 calendar days, the dispute shall be reduced to writing and proceed to Step 2 in the same manner as outlined in subparagraph (a) for the adjustment of employee grievances.

**Step 2:**

The Business Manager or designee of the involved Local Union, together with representatives of the Trades Council and the involved Contractor(s), shall meet in Step 2 within 5 calendar days of the written grievance to arrive at a satisfactory settlement.

**Step 3:**

(a) If the grievance shall have been submitted but not resolved in Step 2, any of the participating Step 2 entities may, within 14 calendar days after the initial Step 2 meeting, submit the grievance in writing (with copies to other participants) to J.J. Pierson, Jr., Esq., who shall act as the Arbitrator under this procedure. The Labor Arbitration Rules of the American Arbitration Association shall govern the conduct of the arbitration hearing, at which all Step 2 participants shall be parties. The decision of the Arbitrator shall be final and binding on the involved Contractor(s), Local Union and employees. The fees and expenses of such arbitration shall be divided equally between the involved Contractor(s) and Local Union.

(b) Failure of the grieving party to adhere to the time limits set forth in this Article shall render the grievance null and void. These time limits may be extended only by written consent of the Project Manager, involved Contractor and involved Local Union at the particular step where the extension is agreed upon. The Arbitrator shall have authority to make decisions only on the issues presented to him and shall not have the authority to change, add to, delete or modify any provision of this Agreement.

**SECTION 2. LIMITATION AS TO RETROACTIVITY**

No arbitration decision or award may provide retroactivity of any kind exceeding 30 calendar days prior to the date of service of the written grievance on the construction Project Manager and the involved Contractor(s) or Local Union.

### **SECTION 3. PARTICIPATION BY CONTRACTOR**

The Contractor shall be notified by the involved Subcontractor of all actions at Steps 2 and 3 and, at its election, may participate in full in all proceedings at these Steps, including Step 3 arbitration.

## **ARTICLE 10 - JURISDICTIONAL DISPUTES**

### **SECTION 1. NO DISRUPTIONS**

There will be no strikes, sympathy strikes, work stoppages, slowdowns, picketing or other disruptive activity of any kind arising out of any jurisdictional dispute. Pending the resolution of the dispute, the work shall continue uninterrupted and as assigned by the Contractor. No jurisdictional dispute shall excuse a violation of Article 7.

### **SECTION 2. ASSIGNMENT**

A. There shall be a mandatory pre-job markup / assignment meeting prior to the commencement of any work. Attending such meeting shall be designated representatives of the Union signatories to this Agreement, the Project Manager, and the involved Contractors. Best efforts will be made to schedule the pre-job meeting in a timely manner after Notice to Proceed is issued but not later than 30 days prior to the start of the Project.

B. All Project construction work assignments shall be made by the Contractor according to the area practice.

### **SECTION 3. PROCEDURE FOR SETTLEMENT OF DISPUTES**

A. Any Union having a jurisdictional dispute with respect to Project work assigned to another Union will submit the dispute in writing to the Administrator, Plan for the Settlement of Jurisdictional Disputes in the Construction Industry ("the Plan") within 72 hours and send a copy of the letter to the other Union involved, the Contractor involved, the Trades Council, and the district or area councils of the unions involved. Upon receipt of a dispute letter from any union, the Administrator will invoke the procedures set forth in the Plan to resolve the

jurisdictional dispute. The jurisdictional dispute letter shall contain the information described in Article IV of the Plan.

B. Within 5 calendar days of receipt of the dispute letter, there shall be meeting of the Contractor, the Contractor involved, the Local Unions involved and designees of the Trades Council and the district or area councils of the Local Unions involved for the purpose of resolving the jurisdictional dispute.

C. In order to expedite the resolution of jurisdictional disputes, the parties have agreed in advance to select Plan Arbitrators J.J. Pierson, Richard Hanft or Andy Douglas to hear all unsolved jurisdictional disputes arising under this Agreement. All other rules and procedures of the Plan shall be followed. If the Plan Arbitrator is not available to hear the dispute within the time limits of the Plan, the Plan's arbitrator selection process shall be utilized to select another arbitrator. In the event that a union involved in the dispute is not a member of the Building and Construction Trades, the dispute shall be submitted directly to Arbitrator J.J. Pierson, Jr., Esq., Richard Hanft or Andy Douglas.

D. The Arbitrator will render a short-form decision within 5 days of the hearing based upon the evidence submitted at the hearing, with a written decision to follow within 30 days of the close of hearing.

E. This Jurisdictional Dispute Resolution Procedure will only apply to work performed by Local Unions at the Project.

F. Any Local Union involved in a jurisdictional dispute on this Project shall continue working in accordance with Section 2 above and without disruption of any kind.

#### **SECTION 4. AWARD**

Any jurisdictional award pursuant to Section 3 shall be final and binding on the disputing Local Unions and the involved Contractor on this Project only, and may be enforced in any court of competent jurisdiction. Such award or resolution shall not establish a precedent on

any other construction work not covered by this Agreement. In all disputes under this Article, the Contractor and the involved Contractors shall be considered parties in interest.

#### **SECTION 5. LIMITATIONS**

The Jurisdictional Dispute Arbitrator shall have no authority to assign work to a double crew, that is, to more employees than the minimum required by the Contractor to perform the work involved; nor to assign work to employees who are not qualified to perform the work involved; nor to assign work being performed by non-union employees to union employees. This does not prohibit the establishment, with the written consent of the involved Contractor, of composite crews where more than 1 employee is needed for the job. The aforesaid determinations shall apply only to whom the disputed work belongs.

#### **SECTION 6. NO INTERFERENCE WITH WORK**

There shall be no interference or interruption of any kind with the work of the Project while any jurisdictional dispute is being resolved. The work shall proceed as assigned by the Contractor until finally resolved under the applicable procedure of this Article. The award shall be confirmed in writing to the involved parties. There shall be no strike, work stoppage or interruption in protest of any such award.

### **ARTICLE 11 - WAGES AND BENEFITS**

#### **SECTION 1. CLASSIFICATION AND BASE HOURLY RATE**

All employees covered by this Agreement shall be classified in accordance with the work performed and paid the base hourly wage rates for those classifications as specified in the attached Schedule A, as amended during this Agreement. Recognizing, however, that special conditions may exist or occur on the Project, the parties, by mutual agreement may establish rates and/or hours for one or more classifications, which may differ from Schedule A. Parties to such agreements shall be the Contractor involved, the involved Local Unions and the Trades Council.



## SECTION 2. EMPLOYEE BENEFIT FUNDS

A. The Contractors agree to pay contributions on behalf of all employees covered by this Agreement to the established employee benefit funds in the amounts designated in the appropriate Schedule A; provided, however, that the Contractor and the Union agree that only such bona fide employee benefits as are explicitly required under N.J.S.A. 34:11-56.30 of the New Jersey State Labor Law shall be included in this requirement and paid by the Contractor on this Project under this Agreement. Bona fide jointly trusted fringe benefit plans established or negotiated through collective bargaining during the life of this Agreement may be added if similarly protected under N.J.S.A. 34:11-56.30. Contractors shall not be required to contribute to non- N.J.S.A. 34:11-56.30 benefits, trusts or plans.

B. The Contractor agrees to be bound by the written terms of the legally established Trust Agreements specifying the detailed basis on which payments are to be paid into, and benefits paid out of, such Trust Funds but only with regard to work done on this Project and only for those employees to whom this Agreement requires such benefit Payments.

C. Should any contractor or sub-contractor become delinquent in the payment of contributions to the fringe benefit funds, then the subcontractor at the next higher tier, or upon notice of the delinquency claim from the Union or the Funds, agrees to withhold from the subcontractor such disputed amount from the next advance, or installment payment for work performed until the dispute has been resolved.

## ARTICLE 12 - HOURS OF WORK, PREMIUM PAYMENTS, SHIFTS AND HOLIDAYS

### SECTION 1. WORK WEEK AND WORK DAY

A. The standard work week shall consist of 40 hours of work at straight time rates per one of the following schedules:

- 1) Five-Day Work Week: Monday-Friday, 5 days, 8 hours plus 1/2 hour unpaid lunch period each day.
- 2) Four-Day Work Week: Monday-Thursday; 4 days, 10 hours plus

½ hour unpaid lunch period each day.

B. The Day Shift shall commence between the hours of 6:00 a.m. and 9:00 a.m. and shall end between the hours of 2:30 p.m. and 7:30 p.m. Starting and quitting times shall occur at the employees' place of work as may be designated by the Contractor.

C. Scheduling - The Contractor shall have the option of scheduling either a five-day workweek, or four-day workweek (when mutually agreed upon on a craft-by-craft basis). The Contractor shall also has the option to set the work day hours consistent with Project requirements, the Project schedule, and minimization of interference with any traffic flow. When conditions beyond the control of the Contractor, such as severe weather, power failure, fire or natural disaster, prevent the performance of Project work on a regularly scheduled work day, the Contractor may, with mutual agreement of the Local Union on a craft-by-craft basis, schedule Friday (where on 4, 10's) during the calendar week in which a workday was lost, at straight time pay; providing the employees involved work a total of 40 hours or less during that workweek.

D. Notice - Contractors shall provide not less than 5 days prior notice to the Local Union involved as to the workweek and work hours schedules to be worked or such lesser notice as may be mutually agreed upon.

## **SECTION 2. OVERTIME**

Overtime pay for hours outside of the standard work week and work day, described in Article 12, § 1A above, shall be paid in accordance with the applicable Schedule A. There will be no restriction upon the Contractor's scheduling of overtime or the non-discriminatory designation of employees who shall be worked, except as noted in Article 5, Section 2. There shall be no pyramiding of overtime pay under any circumstances. The Contractor shall have the right to schedule work so as to minimize overtime.

### SECTION 3. SHIFTS

A. Flexible Schedules - Scheduling of shift work shall remain flexible in order to meet Project schedules and existing Project conditions including the minimization of interference with on-going operations at the Project site. It is not necessary to work a day shift in order to schedule a second shift. Shifts must be worked a minimum of five consecutive work days, must have prior approval of the PM and must be scheduled with not less than five work days notice to the Local Union.

B. Second/Shift - The second shift (starting between 2 p.m. and 8p.m.) shall consist of 8 hours of work (or 10 hours of work) for an equal number of hours pay at the straight time rate plus 15% in lieu of overtime and exclusive of a 1/2 hour unpaid lunch period.

C. Flexible Starting Times -- Shift starting times will be adjusted by the Contractor as necessary to fulfill Project requirements subject to the notice requirements of Paragraph A.

D. Four Tens - When working a four-day work week, the standard work day shall consist of 10 hours work for 10 hours of pay at the straight time rate exclusive of an unpaid 1/2 hour meal period and regardless of the starting time. This provision is applicable to night shifts only, and such night shifts are subject to the shift differential in paragraph B above.

E. It is agreed that when project circumstances require a deviation from the above shifts, the involved unions and contractors shall adjust the starting times of the above shifts or establish shifts which meet the project requirements. It is agreed that neither party will unreasonably withhold their agreement.

### SECTION 4. HOLIDAYS

A. Schedule - There shall be 8 recognized holidays on the Project:

New Years Day	Labor Day
Presidents Day	Veterans Day
Memorial Day	Thanksgiving Day
Fourth of July	Christmas Day

Work shall be scheduled on Good Friday pursuant to the craft's Schedule A.

All the above holidays shall be observed on the dates designated by New Jersey State Law. In the absence of such designations, they shall be observed on the calendar date except those holidays which occur on Sunday shall be observed on the following Monday. Holidays falling on Saturday are to be observed on the preceding Friday.

B. Payment - Regular holiday pay, if any, and/or premium pay for work performed on such a recognized holiday shall be in accordance with the applicable Schedule A.

C. Exclusivity - No holidays other than those listed in Section 4.A, above shall be recognized nor observed except in Presidential Election years when Election Day is a recognized holiday.

#### **SECTION 5. REPORTING PAY**

A. Employees who report to the work location pursuant to regular schedule and who are not provided with work or whose work is terminated early by a Contractor, for whatever reason, shall receive minimum reporting pay in accordance with the applicable Schedule A.

B. When an employee, who has completed his/her scheduled shift and has left the Project site, is "called back" to perform special work of a casual, incidental or irregular nature, the employee shall receive pay for actual hours worked with a minimum guarantee, as may be required by the applicable Schedule A.

C. When an employee leaves the job or work location of his/her own volition or is discharged for cause or is not working because of the Contractor's invocation of Section 7 below, they shall be paid only for the actual time worked.

D. Except as specifically set forth in this Article there shall be no premiums, bonuses, hazardous duty, high time or other special payments of any kind.

E. There shall be no pay for time not actually worked except as specifically set forth in this Agreement and except where an applicable Schedule A requires a full week's pay for forepersons.

#### **SECTION 6. PAYMENT OF WAGES**

A. Payday - Payment shall be made by check, drawn on a New Jersey bank with branches located within commuting distance of the job site. Paychecks shall be issued by the Contractor at the job site by 10 a.m. on Thursdays. If the following Friday is a bank holiday, paychecks shall be issued on Wednesday of that week. Not more than 3 days' wages shall be held back in any pay period. Paycheck stubs shall contain the name and business address of the Contractor, together with an itemization of deductions from gross wages.

B. Termination-Employees who are laid-off or discharged for cause shall be paid in full for that which is due them at the time of termination. The Contractors shall also provide the employee with a written statement setting forth the date of lay off or discharge.

#### **SECTION 7. EMERGENCY WORK SUSPENSION**

A Contractor or the PM may, if considered necessary for the protection of life and/or safety of employees or others, suspend all or a portion of Project Work. In such instances, employees will be paid for actual time worked; provided, however, that when a Contractor requests that employees remain at the job site available for work, employees will be paid for "stand-by" time at their hourly rate of pay.

#### **SECTION 8. INJURY/DISABILITY**

An employee who, after commencing work, suffers a work-related injury or disability while performing work duties, shall receive no less than 8 hours' wages for that day. Further, the employee shall be rehired when able to return to duties provided there is still work available on the Project for which the employee is qualified and able to perform.

## **SECTION 9. TIME KEEPING**

A Contractor may utilize brassing or other systems to check employees in and out. Each employee must check in and out. The Contractor will provide adequate facilities for checking in and out in an expeditious manner.

## **SECTION 10. MEAL PERIOD**

A Contractor shall schedule an unpaid period of not more than 1/2 hour duration at the work location between the 3<sup>rd</sup> and 5<sup>th</sup> hour of the scheduled shift. A Contractor may, for efficiency of operation, establish a schedule which coordinates the meal periods of two or more crafts. If an employee is required to work through the meal period, the employee shall be compensated in a manner established in the applicable Schedule A.

## **SECTION 11. BREAK PERIODS**

There will be no rest periods, organized coffee breaks or other non-working time established during working hours. Individual coffee containers will be permitted at the employee's work location. Local area practice will prevail for coffee breaks that are not organized.

## **ARTICLE 13 - APPRENTICES**

### **SECTION 1. RATIOS**

Recognizing the need to maintain continuing supportive programs designed to develop adequate numbers of competent workers in the construction industry and to provide craft entry opportunities for minorities, women and economically disadvantaged non-minority males, Contractors will employ apprentices in their respective crafts to perform such work as is within their capabilities and which is customarily performed by the craft in which they are indentured. Contractors may utilize apprentices and such other appropriate classifications as are contained in the applicable Schedule A in a ratio not to exceed 25% of the work force by craft (without regard to whether a lesser ratio is set forth in Schedule A), unless the applicable Schedule A provide for

a higher percentage. Apprentices and such other classifications as are appropriate shall be employed in a manner consistent with the provisions of the appropriate Schedule A.

## **SECTION 2. DEPARTMENT OF LABOR**

To assist the Contractors in attaining a maximum effort on this Project, the Unions agree to work in close cooperation with, and accept monitoring by, the New Jersey State and Federal Departments of Labor to ensure that minorities, women, or economically disadvantaged are afforded opportunities to participate in apprenticeship programs which result in the placement of apprentices on this Project. To further ensure that this Contractor effort is attained, up to 50% of the apprentices placed on this Project should be first year, minority, women or economically disadvantaged apprentices. The Local Unions will cooperate with Contractor request for minority, women or economically disadvantaged referrals to meet this Contractor effort.

## **ARTICLE 14 - SAFETY PROTECTION OF PERSON AND PROPERTY**

### **SECTION 1. SAFETY REQUIREMENTS**

Each Contractor will ensure that applicable OSHA requirements and other requirements set forth in the contract documents are at all times maintained on the Project and the employees, and Unions agree to cooperate fully with these efforts. Employees must perform their work at all times in a safe manner and protect themselves and the property of the Contractor and the Owner from injury or harm. Failure to do so will be grounds for discipline, including discharge.

### **SECTION 2. CONTRACTOR RULES**

Employees covered by this Agreement shall at all times be bound by the reasonable safety, security, and visitor rules as established by the Contractors and the Project Manager for this Project. Such rules will be published and posted in conspicuous places throughout the Project.

### **SECTION 3. INSPECTIONS**

The Contractors and Project Manager retain the right to inspect incoming shipments of equipment, apparatus, machinery and construction materials of every kind.

## ARTICLE 15 - NO DISCRIMINATION

### **SECTION 1. COOPERATIVE EFFORTS**

The Contractors and Unions agree that they will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin or age in any manner prohibited by law or regulation. It is recognized that special procedures may be established by the Contractors and Local Unions and the New Jersey State Department of Labor for the training and employment of persons who have not previously qualified to be employed on construction projects of the type covered by this Agreement. The parties to this Agreement will assist in such programs and agree to use their best efforts to ensure that the goals for female and minority employment are met on this Project.

### **SECTION 2. LANGUAGE OF AGREEMENT**

The use of the masculine or feminine gender in this Agreement shall be construed as including both genders.

## ARTICLE 16 - GENERAL TERMS

### **SECTION 1. PROJECT RULES**

The Project Manager and the Contractors shall establish such reasonable Project rules as are appropriate for the good order of the Project, provided they do not violate the terms of this agreement. These rules will be explained at the pre-job conference and posted at the Project site and may be amended thereafter as necessary. Failure of an employee to observe these rules and regulations shall be grounds for discipline, including discharge. The fact that no order was posted prohibiting a certain type of misconduct shall not be a defense to an employee disciplined or discharged for such misconduct when the action taken is for cause.



## **SECTION 2. TOOLS OF THE TRADES**

The welding/cutting torch and chain fall, are tools of the particular trade having jurisdiction over the work performed. Employees using these tools shall perform any of the work of the trade. There shall be no restrictions on the emergency use of any tools or equipment by any qualified employee or on the use of any tools or equipment for the performance of work within the employee's jurisdiction.

## **SECTION 3. SUPERVISION**

Employees shall work under the supervision of the craft foreperson or general foreperson.

## **SECTION 4. TRAVEL ALLOWANCES**

There shall be no payments for travel expenses, travel time, subsistence allowance or other such reimbursements or special pay except as expressly set forth in this Agreement and in Schedule A limited to travel expenses.

## **SECTION 5. FULL WORK DAY**

Employees shall be at their staging area at the starting time established by the Contractor and shall be returned to their staging area by quitting time after performing their assigned functions under the supervision of the Contractor. The signatories reaffirm their policy of a fair day's work for a fair day's wage.

## **SECTION 6. COOPERATION**

The Project Manager and the Unions will cooperate in seeking any New Jersey Department of Labor approvals that may be required for implementation of any terms of this Agreement.

## ARTICLE 17 - SAVINGS AND SEPARABILITY

### **SECTION 1. THIS AGREEMENT**

In the event the application of any provision of this Agreement is enjoined, on either an interlocutory or permanent basis, or otherwise found in violation of law, the provision involved shall be rendered, temporarily or permanently, null and void but the remainder of the Agreement shall remain in full force and effect. In such event, the Agreement shall remain in effect for contracts already bid and awarded or in construction where the Contractor voluntarily accepts the Agreement. The parties to this Agreement will enter into negotiations for a substitute provision in conformity with the law and the intent of the parties for contracts to be let in the future pertaining to this project.

### **SECTION 2. THE BID SPECIFICATIONS**

In the event the Contractor's bid specifications, or other action, requiring that a successful bidder become signatory to this Agreement is enjoined, on either an interlocutory or permanent basis, or otherwise found in violation of law such requirement shall be rendered, temporarily or permanently, null and void but the Agreement shall remain in full force and effect to the extent allowed by law. In such event, the Agreement shall remain in effect for contracts already bid and awarded or in constructions where the Contractor voluntarily accepts the Agreement. The parties will enter in to negotiations as to modifications to the Agreement to reflect the court action taken and the intent of the parties for contracts to be let in the future pertaining to this project.

### **SECTION 3. NON-LIABILITY**

In the event of an occurrence referenced in Section 1 or Section 2 of this Article, neither the Owner, the Project Manager, nor any Contractor, nor any signatory Union shall be liable, directly or indirectly, for any action taken, or not taken, to comply with any court order, injunction or determination. Project bid specifications will be issued in conformance with court orders in effect and no retroactive payments or other action will be required if the original court determination is ultimately reversed.

#### SECTION 4. NON-WAIVER

Nothing in this Article shall be construed as waiving the prohibitions of Article 7 as to signatory Contractors and signatory Unions.

### ARTICLE 18 – HELMETS TO HARDHATS

#### SECTION 1.

The Employers and the Unions recognize a desire to facilitate the entry into the building and construction trades of veterans who are interested in careers in the building and construction industry. The Employers and Unions agree to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment (hereinafter "Center") and the Center's "Helmets to Hardhats" program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs or hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

#### SECTION 2.

The Unions and Employers agree to coordinate with the Center to create and maintain an integrated database of veterans interested in working on this Project and of apprenticeship and employment opportunities for this Project. To the extent permitted by law, the Unions will give credit to such veterans for bona fide, provable past experience.

### ARTICLE 19 - FUTURE CHANGES IN "SCHEDULE A" AREA CONTRACTS

#### SECTION 1. CHANGES TO AREA CONTRACTS

A. Schedule A shall continue in full force and effect until the Contractor and/or Union parties to the Area Collective Bargaining Agreements which are the basis for Schedule A notify the Contractor in writing of the mutually agreed upon changes in provisions of such agreements which are applicable to the Project, and their effective dates.

B. It is agreed that any provisions negotiated into Schedule A collective bargaining agreements will not apply to work on this Project if such provisions are less favorable

to this Project than those uniformly required of contractors for construction work normally covered by those agreements; nor shall any provisions be recognized or applied on this Project if it may be construed to apply exclusively, or predominantly, to work covered by this Project Agreement.

C. Any disagreement between signatories to this Agreement over the incorporation into Schedule A of provisions agreed upon in the renegotiations of Area Collective Bargaining Agreements shall be resolved in accordance with the procedure set forth in Article 9 of this Agreement.

## **SECTION 2. LABOR DISPUTES DURING AREA CONTRACT NEGOTIATIONS**

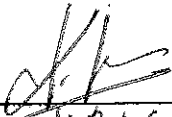
The Unions agree that there will be no strikes, work stoppages, sympathy actions, picketing, slowdowns or other disruptive activity or other violations of Article 7 affecting the Project by any Local Union involved in the renegotiations of Area Local Collective Bargaining Agreements nor shall there be any lock-out on the Project affective a Local Union during the course of such renegotiations.

**SIGNATURE PAGES ATTACHED HERETO**

IN WITNESS WHEREOF the parties have caused this Agreement to be executed and effective as of the \_\_\_\_\_ day of \_\_\_\_\_, 2017.

**SIGNATORIES:**

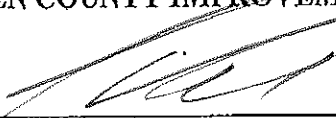
**ROWAN UNIVERSITY/RUTGERS-CAMDEN ("Owner")**

  
\_\_\_\_\_  
Name: KRIS KOLLURI  
Title: CEO

\_\_\_\_\_  
Print Name of Company ("Contractor")

\_\_\_\_\_  
Signature Line  
Print Name: \_\_\_\_\_  
Print Title: \_\_\_\_\_

**CAMDEN COUNTY IMPROVEMENT AUTHORITY ("Project Manager")**

  
\_\_\_\_\_  
Signature Line  
Print Name: Christopher Ochoa  
Print Title: Interim Executive Director

UNITED BUILDING TRADES COUNCIL  
OF SOUTHERN NEW JERSEY

By:   
\_\_\_\_\_ , President

\_\_\_\_\_  
Asbestos Workers #14

\_\_\_\_\_  
Boilermakers #28

\_\_\_\_\_  
Bricklayers/Cement #2

\_\_\_\_\_  
Bricklayers #5

\_\_\_\_\_  
Carpenters #393

\_\_\_\_\_  
Cement Masons #592

\_\_\_\_\_  
Electrical/TeleData Workers #351

\_\_\_\_\_  
Glazier #252

\_\_\_\_\_  
Iron Workers #399

\_\_\_\_\_  
Laborers #172

---

Laborers #222

---

Operating Engineers #825

---

Painters/Tapers #711

---

Plasterers #8

---

Plumbers/Pipe Fitters #322

---

Roofers #30

---

Sheet Metal Workers #19 / Signmakers #194

---

Sprinkler #692

---

Teamsters #676

---

Tile, Marble #7

---

Wharf & Dock #454





### BID DOCUMENT SUBMISSION CHECKLIST

**A. Failure to submit the following documents is a mandatory cause for the bid to be rejected. (N.J.S.A. 40A:11-23.2)**

Required With Submission of Bid (Owner's checkmarks)	Initial Each Item Submitted With Bid (Bidder's initials)
<b>x</b> Bid Guarantee (N.J.S.A. 18A:64-67)	
<b>x</b> Consent of Surety (N.J.S.A. 18A:64-68)	
<b>x</b> Statement of corporate ownership disclosure (N.J.S.A. 52:25-24.2)	
<b>x</b> List of Subcontractors (N.J.S.A. 18A:64-76.1)	
<b>x</b> Form of Proposal (including Acknowledgment of receipt of addenda [if none, return the form indicating "none" or "no addenda"])	
<b>x</b> Disclosure of Investment Activities in Iran ( Public Law 2012, c. 25)	

**B. Failure to submit the following documents may be a cause for the bid to be rejected. (N.J.S.A. 18A:64-52 et seq.)**

Required With Submission of Bid (Owner's checkmarks)	Initial Each item Submitted with Bid (Bidder's initials)	Required with Submission of Bid or before award of Contract (Owner's checkmarks)	Initial Each Item Submitted with Bid (Bidder's initials)
<b>x</b> Non-Collusion Affidavit <b>(this form must be Notarized)</b>		<b>x</b> Affidavit of No Material Change of Circumstances for General Contractor and all listed subs. <b>(this form must be Notarized)</b>	
<b>x</b> Notice of DPMC classification for General Contractor and all listed subs		<b>x</b> Affidavit of Non-Debarred Status	
<b>x</b> Uncompleted contracts for General Contractor and all listed subs.		<b>x</b> Political Contribution Disclosure	
<b>x</b> Certification of Equipment		<b>x</b> Affirmative Action Language	
<b>x</b> Hold Harmless Clause <b>(this form must be notarized)</b>		<b>x</b> NJ Contractor Registration (Dept. of Labor and Workforce Development) (submit before award of contract)	
<b>x</b> Bidders Checklist		<b>x</b> Affirmative Action Plan Tracking form	
<b>x</b> Apprenticeship Program Information (including all subcontractors)		<b>x</b> Wage and Hour Compliance	
<b>x</b> Outreach Utilization Plan		<b>x</b> Public Works Contractor Registration Act Certificate	
<b>X</b> Business Registration Certificate			

**C. SIGNATURE:** The undersigned hereby acknowledges and has submitted the above listed requirements.

SIGNED BY: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

FIRM NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

# NON-COLLUSION AFFIDAVIT

STATE OF \_\_\_\_\_  
COUNTY OF \_\_\_\_\_

:SS:

I, \_\_\_\_\_ of the Township of \_\_\_\_\_  
in the County of \_\_\_\_\_ and the State of \_\_\_\_\_

of full age, being duly sworn according to law on my oath depose and say that:

I am \_\_\_\_\_  
Position in Company \_\_\_\_\_  
of the firm of \_\_\_\_\_ and  
the bidder making the Proposal for the above names contract, and that I executed the said Proposal with full authority so to do; that I have not, directly or indirectly, entered into any agreement, participated in any collusion, discussed any or all parts of this proposal with any potential bidder, or otherwise taken any action in restraint of free, competitive bidding in connection with the above named bid, and that all statements contained in said Proposal and in this affidavit are true and correct, and made with full knowledge that the \_\_\_\_\_ relies upon the truth of the statements contained in said Proposal and in the statements contained in this affidavit in awarding the contract for the said bid.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except bona fide employees of bona fide established commercial or selling agencies maintained by

\_\_\_\_\_  
(Print Name of Contractor)

Subscribed and sworn to: \_\_\_\_\_  
(SIGNATURE OF CONTRACTOR)

before me this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.  
Month Year

\_\_\_\_\_  
NOTARY PUBLIC SIGNATURE Print Name of Notary Public

My commission expires \_\_\_\_\_, \_\_\_\_\_ - Seal -  
Month Day Year

# BID BOND

**CONTRACTOR:**

*(Name, legal status and address)*

« »  
« »

**SURETY:**

*(Name, legal status and principal place of business)*

« »  
« »

**OWNER:**

*(Name, legal status and address)*

« »  
« »

**BOND AMOUNT:** \$ « »

**PROJECT:**

*(Name, location or address, and Project number, if any)*

«test»  
« »  
« »

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this « » day of « », « »

« »  
\_\_\_\_\_  
*(Contractor as Principal)* *(Seal)*

« »  
\_\_\_\_\_  
*(Title)*

« »  
\_\_\_\_\_  
*(Surety)* *(Seal)*

« »  
\_\_\_\_\_  
*(Title)*

\_\_\_\_\_  
*(Witness)*

\_\_\_\_\_  
*(Witness)*

# CONSENT OF SURETY

KNOW ALL MEN BY THESE PRESENT, that \_\_\_\_\_ a corporation of the State of \_\_\_\_\_ having its principal office at \_\_\_\_\_ and \_\_\_\_\_ a corporation of the State of \_\_\_\_\_ having its principal office at \_\_\_\_\_ (a) surety company(ies) qualified to do business in the State of New Jersey, in consideration of the premises and of One Dollar to it (them) in hand paid by the Owner of other good and valuable consideration, the receipt whereof is hereby acknowledged, do(es) consent, and agree, that if the Contract for which the preceding Bid or Proposal is made be awarded to the person or persons making the same, it (they) will, upon the award of such Contract, become security first, for the full and faithful performance of said work, including guarantee for two (2) year and, secondly, for the protection of all persons performing or furnishing labor or materials for the performance of said Contract in the form required by Chapter 2A: 44-143 et seq. R.S. 1937 and the amendments thereof and supplements thereto the Performance Bond and the labor and material obligations each to be in amount equal to 100 percent of the Contract price, and each to be conditioned so as to indemnify the Owner against loss due to the failure of the Contractor to meet the stipulations of Respective Bonds, and if the said person or persons shall omit or refuse to execute such Contract and give the proper security within two (2) days after written notice that the same is ready for execution, if so awarded, and if the sum, which the Owner may be obliged to pay to the person or persons by whom the Contract shall be finally executed, exceeds the sum to which the person or persons making this Bid or Proposal would be entitled, then the said Surety Company or Companies will pay, without proof of notice or demand, to the Owner the amount of any such excess, the sums in each case to be calculated upon the estimated quantities of work, labor and materials by which the Bids are tested.

IN WITNESS WHEREOF, the undersigned corporation has caused this agreement to be signed by its \_\_\_\_\_ and its corporate seal to be hereto affixed and duly attested by its Secretary, this day of \_\_\_\_\_ A.D. 20\_\_.

(Corporate Seal of Company)

\_\_\_\_\_  
Name of Company

Attest:

\_\_\_\_\_  
Secretary

\_\_\_\_\_  
President

NOTICE: The above agreement must be executed under the corporate seal of the Surety Company, attested by its Secretary, and signed by its President or proper officer in the manner prescribed by the Laws of New Jersey. (Surety Company's own form is accepted if in substantial compliance with this form).

# EQUIPMENT CERTIFICATION FORM

I hereby certify that:

A) \_\_\_\_\_ owns all the necessary equipment as  
*Name of Company*  
required by the specifications and to complete the specified public  
work project.

o  
r

B) \_\_\_\_\_ leases or controls all the  
necessary equipment  
*Name of Company*  
as required by the specifications and to complete the specified public work project.

**PLEASE NOTE:** If your company is not the actual owner of the  
equipment, **you shall submit with the bid**

1. A certificate stating the source from which the equipment will be  
obtained and
2. Obtain and submit with the bid a certificate from the owner and person in control of  
the equipment, definitely granting to the bidder the control of the equipment  
required during such time it may be necessary for the completion of that portion of  
the contract for which said equipment will be necessary.

**Name of Company** \_\_\_\_\_

**Address** \_\_\_\_\_ **City,**

**State, Zip** \_\_\_\_\_

**Authorized Agent** \_\_\_\_\_ **Title** \_\_\_\_\_

---

**SIGNATURE OF AUTHORIZED AGENT**

# **SUBCONTRACTOR IDENTIFICATION STATEMENT**

The \_\_\_\_\_ (Name of Bidding  
Company)

**Please Check One!** \_\_\_\_\_ will sub-contract a portion of this project.

\_\_\_\_\_ will not sub-contract any portion of this project.

**Authorized Agent** \_\_\_\_\_ **Title** \_\_\_\_\_

**Signature of Bidder** \_\_\_\_\_ **Date** \_\_\_\_\_

If the bidder is not going to subcontract any portion of this project, the bidder need not complete any further part of this document.

If the bidder will subcontract a portion of this project, the bidder must do the following:

- Identify the contract number and type of work he intends to subcontract;
- Provide the name, address and other pertinent information about the subcontractor;
- Bidder shall provide in the bid package submission the following documents for each named subcontractor:

1. The subcontractor's Notice of Classification;
2. The subcontractor's Total Amount of Uncompleted Contracts; and
3. Contractor's Registration Certificate
4. New Jersey Business Registration Certificate
5. Chapter 271 Political Contribution Disclosure Form
6. Notice of Classification
7. Total Amount of Uncompleted Contracts

Pursuant to N.J.S.A. 40A:11-16 please list the required subcontractor(s) on the following pages.

Bidders may make extra copies of the following pages.

***(Form continued on next page)***

**1. Sub-Contractor for Electrical**

Name of Subcontracting Company \_\_\_\_\_  
Address \_\_\_\_\_  
City, State, Zip \_\_\_\_\_  
Telephone \_\_\_\_\_ Fax \_\_\_\_\_  
E-Mail \_\_\_\_\_ FEIN No: \_\_\_\_\_  
Authorized Agent \_\_\_\_\_ Title \_\_\_\_\_

**3. Sub-Contractor for Plumbing and Gas Fitting**

Name of Subcontracting Company \_\_\_\_\_  
Address \_\_\_\_\_  
City, State, Zip \_\_\_\_\_  
Telephone \_\_\_\_\_ Fax \_\_\_\_\_  
E-Mail \_\_\_\_\_ FEIN No: \_\_\_\_\_  
Authorized Agent \_\_\_\_\_ Title \_\_\_\_\_

**4. Sub-Contractor for Steam & Hot Water Heating & Ventilation Apparatus**

Name of Subcontracting Company \_\_\_\_\_  
Address \_\_\_\_\_  
City, State, Zip \_\_\_\_\_  
Telephone \_\_\_\_\_ Fax \_\_\_\_\_  
E-Mail \_\_\_\_\_ FEIN No: \_\_\_\_\_  
Authorized Agent \_\_\_\_\_ Title \_\_\_\_\_



**STATE OF NEW JERSEY -- DIVISION OF PURCHASE AND PROPERTY  
DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN**

Quote Number: \_\_\_\_\_

Bidder/Offeror: \_\_\_\_\_

**PART 1: CERTIFICATION**

**BIDDERS MUST COMPLETE PART 1 BY CHECKING EITHER BOX.**

**FAILURE TO CHECK ONE OF THE BOXES WILL RENDER THE PROPOSAL NON-RESPONSIVE.**

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that neither the person or entity, nor any of its parents, subsidiaries, or affiliates, is identified on the Department of Treasury's Chapter 25 list as a person or entity engaging in investment activities in Iran. The Chapter 25 list is found on the Division's website at <http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf>. Bidders **must** review this list prior to completing the below certification. **Failure to complete the certification will render a bidder's proposal non-responsive.** If the Director finds a person or entity to be in violation of law, s/he shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the party

**PLEASE CHECK THE APPROPRIATE BOX:**

I certify, pursuant to Public Law 2012, c. 25, that neither the bidder listed above nor any of the bidder's parents, subsidiaries, or affiliates is listed on the N.J. Department of the Treasury's list of entities determined to be engaged in prohibited activities in Iran pursuant to P.L. 2012, c. 25 ("Chapter 25 List"). I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf. **I will skip Part 2 and sign and complete the Certification below.**

**OR**

I am unable to certify as above because the bidder and/or one or more of its parents, subsidiaries, or affiliates is listed on the Department's Chapter 25 list. I will provide a detailed, accurate and precise description of the activities in Part 2 below and sign and complete the Certification below. Failure to provide such will result in the proposal being rendered as non-responsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.

**PART 2: PLEASE PROVIDE FURTHER INFORMATION RELATED TO INVESTMENT ACTIVITIES IN IRAN** You

must provide a detailed, accurate and precise description of the activities of the bidding person/entity, or one of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran outlined above by completing the boxes below.

**EACH BOX WILL PROMPT YOU TO PROVIDE INFORMATION RELATIVE TO THE ABOVE QUESTIONS. PLEASE PROVIDE THOROUGH ANSWERS TO EACH QUESTION. IF YOU NEED TO MAKE ADDITIONAL ENTRIES, CLICK THE "ADD AN ADDITIONAL ACTIVITIES ENTRY" BUTTON.**

Name _____ Relationship to Bidder/Offeror _____
Description of Activities _____
Duration of Engagement _____ Anticipated Cessation Date _____
Bidder/Offeror Contact Name _____ Contact Phone Number _____

Delete

ADD AN ADDITIONAL ACTIVITIES ENTRY

Certification: I, being duly sworn upon my oath, hereby represent that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I acknowledge: that I am authorized to execute this certification on behalf of the bidder; that the State of New Jersey is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the completion of any contracts with the State to notify the State in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the State, permitting the State to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print): \_\_\_\_\_ Signature: \_\_\_\_\_

**Do Not Enter PIN as a Signature**

Title: \_\_\_\_\_ Date: \_\_\_\_\_



# State of New Jersey

DEPARTMENT OF THE TREASURY  
DIVISION OF PROPERTY MANAGEMENT AND CONSTRUCTION  
33 W. STATE STREET  
PO BOX 034  
TRENTON, NEW JERSEY 08625-0034

REPLY TO:  
TEL: (609) 943-3400  
FAX: (609) 292-7651

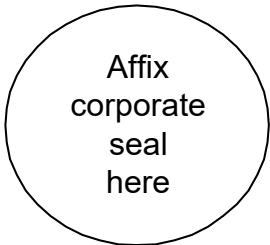
## TOTAL AMOUNT OF UNCOMPLETED CONTRACTS

*(This form is to be used with the NOTICE OF CLASSIFICATION when submitting bids to the Department of Education.) I*

Certify that the amount of uncompleted work on contracts is \$ \_\_\_\_\_.

*The amount claimed includes uncompleted portions of all currently held contracts from all sources (public and private) in accordance with N.J.A.C. 17:19-2.13.*

*I further certify that the amount of this bid proposal, including all outstanding incomplete contracts does not exceed my prequalification dollar limit.*



Respectfully submitted,

By \_\_\_\_\_

Name of Firm

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Phone

Sworn to and  
subscribed before me  
This day of  
20

**Notary Public**

STATE TREASURER'S LIST OF DEBARRED, SUSPENDED AND DISQUALIFIED  
BIDDERS

The Contractor shall submit with his bid a sworn statement, as set forth herein signed by an officer or partner of the Contractor, indicating whether or not the Contractor is at the time of the bid, included on the State Treasurer's List of Debarred, Suspended, or Disqualified Bidders. The Contractor will immediately notify the Owner whenever it appears that a Contractor is on the State Treasurer's List. The Contractor may be debarred, suspended or disqualified from contracting with the State of New Jersey if the Contractor commits any of the acts listed in N.J.A.C. 7:1 D-2.2.

STATE OF NEW JERSEY

§:

COUNTY OF \_\_\_\_\_

I, \_\_\_\_\_ of the City of \_\_\_\_\_  
in the County of \_\_\_\_\_ and the State of \_\_\_\_\_ of full  
age, being duly sworn according to law on my oath depose and say that:

I am-----' an officer of the firm of

\_\_\_\_\_ the bidder making the Proposal for the above named work, and that I executed the said Proposal with full authority to do so that said bidder at the time of making of this bid, is not included on the State of New Jersey, State Treasurer's List of Debarred, Suspended and Disqualified Bidder; and that all statements contained in said Proposal and in this affidavit are true and correct, and made with the full knowledge that the Owner as Local Unit relies upon the truth of the statements contained in said Proposal and in the statements contained in this affidavit in awarding the contract for said work.

The undersigned further warrants that should the name of the firm making this bid appear on the State Treasurer's List of Debarred, Suspended and Disqualified Bidders at anytime prior to, and during the life of this Contract, including the Guarantee Period, that Rowan University/Rutgers Camden Board of Governors shall be immediately notified by the signatory of this Eligibility Affidavit.

The undersigned understands that the firm making the bid as a Contractor is subject to debarment, suspension and/or disqualification -in contracting with the State of New Jersey and the Department of Environmental Protection if the Contractor, pursuant to N.J.A.C. 7:1D-2.2 commits any of the acts listed therein, and as determined according to applicable law and regulation.

---

(Insert Name and Address of Contractor)

---

(Insert Name and Title of Affiant)

Subscribed and sworn

before me this \_\_\_\_\_ day  
of \_\_\_\_\_ 20\_\_

---

Notary Public of \_\_\_\_\_  
My commission expires \_\_\_\_\_, 20\_\_

# POLITICAL CONTRIBUTIONS DISCLOSURE FORM

The undersigned, being authorized and knowledgeable of the circumstances, does hereby certify that \_\_\_\_\_ (Business Entity) has made the following **reportable** political contributions to any elected official, political candidate or any political committee as defined in N.J.S.A. 19:44-20.26 during the twelve (12) months preceding this award of contract:

### Reportable Contributions

<u>Date of Contribution</u>	<u>Amount of Contribution</u>	<u>Name of Recipient Elected Official/ Committee/Candidate</u>	<u>Name of Contributor</u>

The Business Entity may attach additional pages if needed.

**No Reportable Contributions** (Please check (✓) if applicable.)

I certify that \_\_\_\_\_ (Business Entity) made no reportable contributions to any elected official, political candidate or any political committee as defined in N.J.S.A. 19:44-20.26.

### Certification

I certify, that the information provided above is in full compliance with Public Law 2005—Chapter 271.

Name of Authorized Agent \_\_\_\_\_

Signature \_\_\_\_\_ Title \_\_\_\_\_

Business Entity \_\_\_\_\_

## **SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS**

### **1. INVITATION TO BID**

- A. Bids for the Joint Health Sciences Center Café Fitout will be received on April 7, 2020 at 3:00 PM by the Rowan University/Rutgers – Camden Board of Governors (“RURCBOG”) located at 201 S Broadway, Camden, New Jersey 08103. Bids shall include one (1) original and three (3) copies. Original should be stamped original.
- B. Before submitting a Proposal, the Bidder shall become familiar with the Drawings, Specifications and other documents that will form the Contract. The bidder shall investigate the site of the Project and make such examination thereof as may be necessary to determine the character and amount of work involved. Site access requests beyond the pre-bid meeting site inspection shall be requested via email through the Construction Manager per the process in Section 5.B of this Specification. The bidder shall also determine that it can secure the necessary labor and equipment and that the materials it proposes to use will comply with the requirements specified therefore and can be obtained by it in the quantities and at the time required.
- C. The RURCBOG reserves the right to reject all bids as permitted in N.J.S.A. 40A: 11-13.2 and 18A:64-52 et seq., if necessary, or to waive any informalities in the bids, and unless otherwise specified by the bidder, to accept any item, items or services in the bids should it be deemed in the best interest of the RURCBOG to do so.
- D. All bidders, and the successful bidder going forward, must comply with the requirements of the State College Contracts Law, N.J.S.A 18A: 64-52 et seq.
- E. In the case of default by the bidder or contractor, the RURCBOG may procure the articles or services from other sources and hold the bidder or contractor responsible for any excess cost occasioned thereby.
- F. The Bid Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement For Bids, the Instructions to Bidders, any Supplementary Instructions to Bidders, the Proposal Form and any other bidding and contract forms included or referenced in the Specifications. The Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and any other Conditions), the Drawings, Specifications and all Addenda issued during the bidding period.

The bidder, if awarded the contract, agrees to protect, defend and save harmless the RURCBOG, against damage for payment for the use of any patented material process, article or devise that may enter into the manufacture, construction or form a part of the work covered by either order or contract, and he further agrees to indemnify and save harmless the RURCBOG from suits or actions of every nature and description brought against it, for, or on account of any injuries or damages received or sustained by any party or parties by, or from any of the acts of the contractor, its servants or agents.

- G. Bid Documents may be obtained at the office of the RURCBOG.
  - (i) Drawings and Specifications can be obtained from the office of McKernan Architects, 100 Dobbs Lane, Suite 204, Cherry Hill, New Jersey 08034, upon a non-refundable payment of \$50.00 for a disk

(Bidders are responsible for the cost of all reproductions). Payments (non-refundable) should be made via certified check or money order, made payable to the RURCBOG.

- H. This Project is subject to a Project Labor Agreement. The Project Labor Agreement will be available for review at the offices of the RURCBOG, 201 S Broadway, Suite 440, Camden, New Jersey 08103

## 2. OBLIGATION OF BIDDER

At the time of the opening of bids each Bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Bid Documents and Drawings and other Contract Documents, including all Addenda and Bulletins. The failure or omission of any Bidder to receive or examine any form, instrument of document or to visit the site and acquaint itself with conditions there existing, shall not relieve any Bidder from any obligation with respect to its bid.

## 3. QUALIFICATION OF BIDDERS

- A. **Bidders must be prequalified by the New Jersey Division of Property Management and Construction (NJDPMC) for Classification C006 – Construction Manager as Constructor or C008 – General Construction. Bidders must be classified themselves or have their classified subcontractor(s) for the following trade(s): Plumbing (C030), HVACR (CO32), Electrical (C047).**

\* Note: If the HVAC Contractor or Subcontractor has applied for the new, state-required, HVACR license, but has yet to receive same, and therefore has yet have its DPMC classification changed from CO39 (HVAC) to CO32 (HVACR), it must provide proof of filing (1) an application with the State for the HVACR license; (2) proof that it has notified the DPMC of this pending application; and (3) proof of its current CO39 CPMC classification.

- B. Each Bidder shall include with its Bid, for itself and where stated for each of the proposed Subcontractors listed under section 004346 (Subcontractor list) the following:
  - (i) Affidavit: Certifying no material change of circumstances.
  - (ii) "Notice of Classification" form by the State of New Jersey, Department of Property Management and Construction showing evidence that the Bidder (or Subcontractor) has been pre-qualified by the State of New Jersey, Department of Property Management and Construction prior to the date that Bids are accepted, for the bidder and each listed subcontractor.
  - (iii) "Total Amount of Uncompleted Contracts" form by the State of New Jersey, Department of Property Management and Construction (DPMC 701-0591), for the bidder and each listed subcontractor.
- C. In accordance with "the Public Works Contractor Registration Act" (P.L. 1999, c.238) each bidder, and each of its Prime subcontractors listed in section 004346, must submit with his bid a copy of registration with the New Jersey Department of Labor and Workforce Development.

No Contractor/Subcontractor will be permitted to bid on or engage in any contract for public work, as defined in section 2 of P.L. 1963, c.150 (c.34:11-56.25), unless that Contractor/Subcontractor is registered with the New Jersey Department of Labor and Workforce Development.

- D. In accordance with N.J.S.A. 52:32-44, each bidder and each of its subcontractors shall submit a copy of its Business Registration Certificate prior to award of a contract.

#### 4. AFFIRMATIVE ACTION

- A. In accordance with Affirmative Action Law, P.L. 1975, c.127 (N.J.A.C. 17:27) with implementation of July 10, 1978, successful bidder must agree to obtain individual employer certification and number and complete Affirmative Action Employee Information Report (Form AA-302). Also, during the performance of this contract, the contractor agrees as follows: (a) The contractor or subcontractor where applicable, will not discriminate against any employee because of age, race, creed, color, religion, Vietnam-era veteran status, national origin, ancestry, marital status disability, or affectional or sexual orientation, genetic information, sex or atypical hereditary, cellular or blood trait. The contractor will take affirmative action to ensure that such applicants are recruited and employed and that employees are treated during employment, without regard to their age, race, creed, color, religion, Vietnam-era veteran status, national origin, ancestry, marital status, sex, affectional or sexual orientation, genetic information, sex or atypical hereditary, cellular or blood trait. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notice provided by the Public Agency Compliance Officer setting forth provisions of this non-discrimination clause: (b) the contractor or subcontractor, where applicable, will in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, sex or handicap; (c) the contractor or subcontractor, where applicable, will send to each labor union or representative or workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer advising the labor union or worker's representative of the contractor's commitments under this act and shall post copies of the notice; (d) the contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer pursuant to the P.L. 1975, c.127, as amended and supplemented from time to time.

#### 5. INTERPRETATIONS AND ADDENDA

- A. The Bidder shall carefully study the Bid Documents and compare them with each other, shall examine the Project site and local conditions and shall immediately report to the Rowan University/Rutgers – Camden Board of Governors in writing any errors, inconsistencies and ambiguities discovered.
- B. No oral interpretations will be made to any Bidder as to the meaning of the Bid Documents, drawings and specifications. **Questions regarding the bid must be made via e-mail to and through John McQuilkin at McKernan Architects with a copy to Dennis Hayes at STV Inc. and the Rowan University/Rutgers – Camden Board of Governors by email to Dean D'Astuto on or before**



**March 25, 2020 @ 4:00 PM local time.** No inquiry received after the above date will be given consideration. Interpretations made to a Bidder will be in the form of an Addendum which, when issued, will be sent promptly to all persons to whom the drawings and specifications have been issued. If no response is provided to a submitted question bidders shall assume that no change to the Bid Documents is considered necessary or desirable in response to the question.

- C. During the bidding period, the Rowan University/Rutgers – Camden Board of Governors may furnish Addenda for additions to or alterations of the drawings and specifications, which shall be included in the work covered by the Proposals. Addenda will be sent by email, certified mail, or express delivery, and shall be posted on the RURCBOG website at RURCBOGNJ.com not later than seven (7) days (Saturday, Sundays and holidays excepted) before Bid opening to all bidders, however, the RURCBOG shall not be responsible for the failure of delivery to any one bidder. It shall be the responsibility of the bidder to ascertain that it has received all addenda issued prior to submitting its bid.

All Addenda issued, whether or not received or examined by the Bidder, is part of the Bid Documents, and will be part of the Contract Documents, as though originally incorporated in the Project Manual. Failure of the bidder to receive or examine any Addendum shall not relieve the Bidder from any of the requirements of the Documents.

#### **6. PRE-BID MEETING (This meeting is non-mandatory)**

There will be a pre-bid meeting for the project to be held at the Joint Health Sciences Center, located at 201 South Broadway, Camden, New Jersey 08103 on March 18, 2020 at 10:00 AM. Although the meeting is non-mandatory pursuant to legal authority, all potential bidders are strongly encouraged to attend. Failure to attend will not excuse bidder from any potential modification in performance scope which would have been visible or evident at a site inspection. The Owner reserves the right to schedule additional meetings if it is in the best interest of the project.

Whenever a bid calls for an on-site inspection or a pre-bid meeting, by no means is anyone to assume that answers given at the site inspection or pre-bid meeting are binding unless confirmed in writing via an addendum prior to the bid opening by the Purchasing Department.

The failure of any prospective Contractor to visit the site and acquaint itself with conditions existing thereon shall not relieve any bidders from any obligation with respect to its bid.

#### **7. REQUESTS FOR SUBSTITUTIONS**

Requests for substitutions must be in compliance with specification section 01 63 00. By submitting a bid, the Bidder understands and guarantees that he will comply with all materials as specified, or equivalent with the SCCL, and N.J.A.C. Regulations.

Any prospective bidder who wishes to challenge a bid specification shall file such challenge in writing with the RURCBOG no less than seven (7) business days prior to the opening of the bids. Challenges filed after that time shall be considered void and having no impact on the contracting unit or the award of a contract.

(N.J.S.A. 18A:64-64).

## 8. PREPARATION OF BIDS

- A. Enclose Proposals in a sealed envelope, identified on the outside with name and address of bidder, Contract General Construction. Bids may not be modified after submittal. Bidders may withdraw bids at any time before opening.

No vendor shall influence, or attempt to influence or cause to be influenced, any RURCBOG officer or employee to use his/her official capacity in any manner which might tend to impair the objectivity or independence of judgment of said officer or employee.

No vendor shall cause or influence, or attempt to cause or influence, any RURCBOG officer or employee to use his/her official capacity to secure unwarranted privileges or advantages for the vendor or any other person.

- B. Bid Proposals shall be submitted on the form of proposal furnished in the bid documents, properly filled out and duly executed. Bid Proposal forms shall not be altered or added to in any way. Lump Sum Bid or Base prices shall be filled in, in ink or typewritten in both words and figures. In case of discrepancy, the amount described in words shall govern.

All blank spaces in the bid form must be filled out or completed by the Bidder. Incomplete spaces on the bid form may be reason for rejection of bid. Any changes, whiteouts, strikeouts, etc., on the proposal page must be initialed by the person responsible for signing the bid.

By submission of bid, the bidder certifies that the merchandise to be furnished will not infringe upon any valid patent or trademark and the successful bidder shall, at this own expense, defend any and all actions or suits charging such infringement, and will save the RURCBOG harmless in any case of any such infringement.

- C. When the proposal is made by an individual, his post office address shall be stated and he shall sign the proposal. When made by a firm or partnership or limited liability company, its name and post office address shall be stated and the proposal shall be signed by one or more of the partners or member, as appropriate. When made by a corporation, its name and principal post office address shall be stated, and the proposal shall be signed by an authorized official of the corporation.
- D. Bidders submitting Proposals pursuant to N.J.S.A. 18A:64-76 shall include names of subcontractors proposed for use in performance of Plumbing, Drainage and Sprinkler; Heating, Ventilation and Air Conditioning, Electrical Work as per section 004346.
- E. Bids not based on the Bid Documents (including all Addenda issued), Bids containing a qualification or exception to the requirements of the Bid Documents, conditional or uninvited alternative Bids, Bids that are not complete or properly signed for submitted in accordance with the requirements of the Bid Documents and Bids containing an alteration of a form or irregularity of any kind may be rejected.
- F. In addition to the requirements specified above, each Bid shall include or be accompanied by:

- (i) Bid Security and Power of Attorney made payable to **the Rowan University/Rutgers – Camden Board of Governors** in the amount of ten percent (10%) of the Bid sum, but not to exceed \$20,000.00. Securities shall be either certified check, cashier's check, or Bid Bond by a surety licensed to conduct business in New Jersey.
  - a. A successful Bidder's bid security will be retained until the Bidder has signed the Contract and furnished the required Performance Bond(s), Labor and Materials Payment Bond(s), and Maintenance Bond(s).
  - b. The Owner reserves the right to retain the bid securities of the three (3) lowest responsible bidders for up to three (3) days (Sundays, and holidays excepted) after the awarding and signing of the Contract with the successful Bidder and the approval of the Bidder's bonds or until sixty (60) days after Bid opening, whichever occurs first. All other bid securities will be returned within ten (10) days (Sundays and holidays excepted) after opening of Bids.
  - c. If a Bidder fails to enter into a Contract and furnish the required bonds within (10) days after it has received notice of acceptance of its Bid, the Owner will retain that Bidder's bid security as liquidated damages, not as a penalty.
- (ii) Consent of Surety, in accordance with N.J.S.A. 18A:64-68, from a surety company licensed to conduct business in New Jersey, stating that it will provide the Bidder (or Subcontractor identified by the Bidder), if the Bidder is awarded the Contract, with the required Performance Bond, the required Labor and Material Payment Bond, and the required Maintenance Bond along with a surety disclosure statement and certification for each bond.
  - a. The Bidder must furnish with its Bid specific evidence of performance and payment securities totaling one hundred (100%) percent of the Bid amount including the work of each of the Subcontractors listed under Part One.
  - b. If the Bidder is awarded a Contract, performance, payment, and maintenance securities may be supplied by those individual Subcontractors on behalf of themselves and the Bidder, by the Bidder on behalf of itself and any or all of those Subcontractors, or by any combination thereof as long as the amount of the resulting Performance Bond(s) equals the total Contract Sum and the amount of the resulting Payment Bond(s) equals the total Contract Sum and all of these bonds name the Bidder as a principal. If the Bidder furnishes its Bonds covering itself and any subcontractor, only the Bidder need be named as a Principal.
  - c. Any Consent of Surety furnished by a proposed Subcontractor shall specify the dollar value of the Subcontractor's portion of the Work and shall name both the Bidder and the Subcontractor as the proposed principals.
  - d. If the bidder proposes to furnish bonds that cover both the Bidder and one or more of its Subcontractors, the Consent of Surety shall specify the dollar value of the Work covered and shall name the Bidder and cover the work of each Subcontractor included therein.

- e. The bonding company or companies shall be NJ Department of Insurance and Banking approved, shall have an A.M. Best Company rating of "A-" or better and meet all the requirements of N.J.S.A. 2A: 44-143.
- (iii) Subcontractor List – Failure to identify all of the Subcontractors, persons and entities to be engaged for the work identified in section 004346 shall be cause for the bid to be rejected.
- (iv) Non-Collusion Affidavit.
- (v) Disclosure Statement setting forth names and addresses of all stockholders, members or partners who hold ten percent (10%) or greater interest in any corporation of partnership bidding on the Project, in accordance with N.J.S.A. 52:25-24.2.
- (vi) A letter from the Bidder's insurance company stating that if the bidder is awarded the Contract the insurance company will, within ten (10) days of award, furnish the Bidder with a policy or policies of insurance of the types and in the amounts required by Article 11 of the General and Supplement Conditions of the Contract.
- (vii) Bidder's acknowledgement of receipt of any notice(s) or revision(s) or addenda to an advertisement, specifications of bid document(s).
- (viii) Such other items as set forth in the Bid Proposal Form or Bidders checklist.

## **9. PROPOSAL GUARANTEE**

- A. The Proposal, when submitted, shall be accompanied by a Proposal Guarantee in the form of a Certified Check, Cashier's Check or acceptable Bid Bond made payable to the Owner, in the sum of ten percent (10%) of the Base Bid Proposal, but in no case in excess of \$20,000.00. If a Bid Bond is submitted, it shall be in the form located at section 00 43 14, or in lieu thereof, the AIA Document A310, or other form acceptable to the RURCBOG.
- B. Pursuant to N.J.S.A. 18A:64-67, Proposals shall be accompanied by a Proposition of Surety in form as found in these documents, assuring that satisfactory arrangements have been made between the surety and the Bidder by which surety agrees to furnish Bidder with a Performance Payment Bond, a guaranty and Performance Bond, (Construction) and Corporate Surety Bond as per N.J.S.A. 2A:44-147 (Labor and Materials-Construction), and a Maintenance Bond along with a Surety Disclosure Statement and Certification for each bond and General Power of Attorney, and Maintenance Bond. The Proposition of Surety shall be executed by an approved surety company authorized to do business in the State of New Jersey or by the individual if an individual surety is being offered by the bidder.
- C. Pursuant to N.J.S.A. 18A:64-70, all Proposal Guarantees, except those of the three apparent lowest responsible bidders, will returned, if requested after ten days from opening of bids, Sunday and holidays excepted. Within 3 days after the awarding of the contract and the approval of the Bidder's performance-payment bond, the bid security of the remaining unsuccessful bidders will be returned, Sunday and holidays excepted.
- D. The Proposal Guarantee shall be forfeited if Bidder fails to execute the Agreement and furnish the guaranty and Performance Bond, (Construction) and

Corporate Surety Bond as per N.J.S.A. 2A:44-147 (Labor and Materials-Construction) along with a Surety Disclosure Statement and Certification for each bond and general Power of Attorney, with ten (10) days after notification of aware of Contract to him. In the event of default and subsequent award to another Bidder, the Proposal Guarantee will become liable up to its full amount for the difference between the amount of the bind in default, including Alternate Bids, which the Owner wished to accept and that amount for which the Owner is obligated on award to another Bidder, plus any additional expenses related thereto. To the extent that the Proposal Guarantee does not satisfy the foregoing amount, Bidder shall be liable for the difference.

## **10. CONTRACT BONDS**

- A. The bidder to whom the Contract has been awarded shall, within ten (10) days after notification of award of contract, furnish and deliver a guaranty and Performance Bond, (Construction) and Corporate Surety Bond as per N.J.S.A. 2A:44-147 (Labor and Materials-Construction) along with a Surety Disclosure Statement and Certification for each bond and General Power of Attorney, equal to one hundred percent (100%) of the Contract Amount. If, at any time after execution and approval of a Contract and the guaranty and Performance Bond (Construction) and Corporate Surety Bond as per N.J.S.A. 2A:44-147 (Labor and Materials-Construction) along with a Surety Disclosure Statement and Certification for each bond and General Power of Attorney, required by Contract Documents, such Bond shall cease to be adequate security for the Owner, the Contractor shall, within five (5) days after notice to do so, furnish a new or additional Bond, in form, sum and signed by such Sureties as shall be satisfactory to the Owner. No further payment shall be deemed due nor shall any further payment be made to the Contractor unless and until such new or additional Bond shall be furnished and approved. Surety must be authorized to do business in the State of New Jersey.
- B. Prior to start of guarantee period and before the final payment is made, the Contractor shall provide the Owner with a Maintenance Bond in the amount of ten percent (10%) of Final Contract Amount, to insure the replacement or repair of defective materials or workmanship during the one-year guarantee period.
- C. The cost of all Bonds shall be paid for by the Contractor and shall be included as a part of Contractor's bid price.

## **11. POWER OF ATTORNEY**

Attorneys-in-fact who sign Bid Bonds, Performance-Payment Bonds, a guaranty and Performance Bond, (Construction) and Corporate Surety Bond as per N.J.S.A. 2A:44-147 (Labor and Materials-Construction) along with a Surety Disclosure Statement and Certification for each bond and General Power of Attorney, Maintenance Bonds and Proposition of Surety forms must accompany each bond or proposition with a certified and effectively dated copy of their power-of-attorney.

## 12. FORM OF AGREEMENT

The form of agreement shall be AIA Document A132/CMA Standard Form of Agreement between Owner and Contractor (Stipulated Sum) 2009 Edition and AIA Document A232 General Conditions of the Contract for Construction 2009 Edition, with modifications. A sample form is attached to these Bidding and Contract documents which contains certain modifications intended by the RURCBOG. The RURCBOG reserves the right to make corrections, additions, or modifications to said Contract.

## 13. AWARD OF CONTRACT

- A. Award(s), if made, will be to the lowest responsible bidder, who has been determined responsive by the RURCBOG, including Alternate Bids, if any, which the Owner chooses to accept.
- B. Award made to a Bidder is conditioned upon Bidder designating a proper agent in the State on whom service can be made in the event of litigation.
- C. If the successful Bidder is a corporation not organized under the laws of New Jersey, the award of Contract and payment of consideration thereunder shall be conditioned upon Corporation promptly filing a Certificate of Authority to Transact Business in the State of New Jersey pursuant to N.J.S.A. 14A:13-2 and complying with the provisions of N.J.S.A. 14A:13-4.
- D. Whenever two or more bids of equal amounts are the lowest bids submitted by responsible bidders, the Owner may award the Contract to any one of such bidders as in its discretion it may determine.
- E. The Bidder to whom the contract is awarded shall be required to execute the Contract and deliver all Bonds and Insurance Certificates required within ten (10) days after notification of award of contract to it.
- F. Note that no contract can be awarded to a contractor appearing on the New Jersey Department of Labor and Workforce Development's list of contractors not paying prevailing wages until after the indicated date of expiration of the contractor's listing, in accordance with N.J.S.A. 34:11-56.37 and N.J.S.A. 34:11-56.38.
- G. The Bidder awarded the Contract for the Project will be required to comply with:
  - (i) State College Contracts Law, N.J.S.A. 18A:64-52 et seq.
  - (ii) New Jersey "Law Against Discrimination", N.J.S.A 10:5-1 et seq. Bidders are required to comply with the requirements of N.J.P.L. 1975, c. 127.
  - (iii) New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.27 et seq.
  - (iv) Certification and submission of payroll records for each pay period, N.J.A.C 12:60-2.1 and 6.1.

- (v) Foreign product limitations, in accordance with N.J.S.A. 52:32-1, N.J.S.A. 52:33-1 et seq., and N.J.S.A. 40A:11-18.

#### 14. SAMPLE FORMS

The following forms and information are included hereinafter for the Bidder's use:

1. Form of Proposal
2. Bidders Checklist
3. Bid Bond
4. Consent of Surety
5. Subcontractors Identification Form
6. Total Amount of Uncompleted Contracts
7. Public Works Contractor Registration Act
8. Disclosure of Investment Activities in Iran
9. Affidavit of Non-Debarred Status
10. Hold Harmless
11. Non-Collusion Affidavit
12. No Material change of Circumstance
13. Stockholder/Partnership Disclosure Affidavit
14. Business Registration Certificate
15. Agreement Between Owner & Contractor, AIA Document A132/CMA (2009)
16. Political Contribution Form
17. Equipment Certification
18. General conditions of the Contract for Construction
19. Affirmative Action Language
20. Statement of No Material Change Form
21. Mandatory Equal Employment Opportunity Language
22. Prevailing Wage Compliance Declaration

#### 15. TIME

- A. The Contract Substantial Completion Date is **one hundred (100)** days from receipt of permits with Final Completion **10 days later**. Refer to the "GENERAL CONDITIONS IN THE CONTRACT FOR CONSTRUCTION" for "Time of Completion" and to the milestone dates at the end of Section 01 11 13 Summary of Work.
- B. In submitting a Bid, the Bidder agrees, if awarded the Contract, to complete the Work within the "Project Completion" time limits set forth in the Summary of Work and the "GENERAL CONDITIONS IN THE CONTRACT FOR CONSTRUCTION". The Bidder also represents that it has fully familiarized itself with the Contract Documents and the site, and it agrees that it can complete all of the Work within those time limits.
- C. In submitting a Bid, the Bidder agrees, if awarded the Contract, to pay the Owner as liquidated damages of \$500.00 per day for Interim Milestones (see Logistics Schedule made part of Contract Documents) and \$1,000.00 per day for Substantial and Final Completion Milestones, not as a penalty, as set forth in the "GENERAL CONDITIONS IN THE CONTRACT FOR CONSTRUCTION" for each consecutive calendar day beyond the milestone and completion date(s) established in the Summary of Work and the "GENERAL CONDITONS IN THE CONTRACT FOR CONSTRUCTION" that the Contractor takes to complete the Work in accordance with the Contract Documents.

- D. Liquidated damages shall not in any way release the Bidder from the obligations of its Contract with the Owner. Liquidated damages shall not in any way release the Bidder from its obligation to indemnify and hold harmless the Owner, Construction Manager, Architect, and their consultants and agents and employees from and against claims, damages, losses and expenses in accordance with the Contract Documents.
- E. Additionally, in submitting a Bid, the Bidder agrees, if awarded the Contract, to pay to the Owner, under the requirements of N.J.S.A. 18A:64-77, any and all wages or considerations paid by the Owner to inspectors necessarily employed by the Owner for the number of days beyond the completion date(s) established in Summary of Work and the "GENERAL CONDITIONS IN THE CONTRACT FOR CONSTRUCTION" that the Bidder takes to complete the Work in accordance with the Contract Documents.

**16. LISTING OF STOCKHOLDERS OR PARTNERS**

- A. Pursuant to N.J.S.A. 52:25-24.2, prior to the receipt of the bid, or accompanying the bid, all corporate or partnership bidders shall submit a statement setting forth the names and addresses of all stockholders in the corporation or partnership who own 10% or more of its stock, of any class or of all individual partners in the partnership who own 10% or greater interest therein, as the case may be. If one or more such stockholder or partner is itself a corporation's stock, or the individual partners owning 10% or greater interest in that partnership, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every non-corporate stockholder and individual partner, exceeding the 10% ownership criteria established in this act, has been listed.
- B. Any bidder whose stockholders or partners own less than ten percent (10%) of the stock shall certify such fact to the Owner as a condition of his bid.

**17. NON-COLLUSION AFFIDAVIT**

- A. Pursuant to N.J.S.A. 52:34-15 and N.J.S.A. 18A:64-6.1, bidder shall submit with its bid Non-Collusion affidavit on form as bound herein.

**18. OWNER'S REQUIREMENTS FOR SAFETY AND HEALTH PROGRAM**

- A. The Owner requires that the successful Bidder(s) demonstrate a health and safety program/plan (HASP) referencing first aid, fire protection, housekeeping, illumination, sanitation, personal protective equipment, medical exits and emergency action plans. This document will be site specific for inspection and training and will serve to communicate these work practice to all project contractors, their subcontractors and employees. The HASP shall be in accordance with OSHA 29 CFR.
- B. As of November 1986, all New Jersey Governmental Agencies are mandated to comply with Public Employment -- Occupational Safety and Health Act legislation that closely adheres to the Federal Occupational Safety and Health Act of 1970, requiring compliance with safety standards thereof. As of this date, all equipment owned and operated by the RURCBOG shall meet the established standards. It is therefore imperative that all concerned be made aware of and comply with the following:



The vendor or contractor hereby guarantees that all materials, supplies, and equipment furnished or delivered to the RURCBOG as listed on any bid, request for proposal, quotation, contract or purchase order meet the requirements, specifications and standards as provided for under the Federal Occupational Safety and Health Act of 1970, as from time to time amended and enforced as of the date thereof.

- C. New Jersey Worker and Community Right To Know Act: Under the provisions of this regulation each bidder must furnish The RURCBOG a "Safety Data Sheet" for each product they supply The RURCBOG. These SDS's should be submitted to the RURCBOG upon award of the bid. They should be directed to the department(s) receiving the product or services. In addition, the vendors are required to comply with labeling requirements as detailed in the Act as well as all other applicable provisions of the Act.
- D. The RURCBOG retains the right to have representatives of O.S.H.A. inspect the construction project.

In an effort to provide contractors with an overview of areas of concern, the following information is provided to all general contractors working on RURCBOG property or under the RURCBOG's auspices. It is the general contractor's responsibility to insure that their subcontractors are in compliance.

- 1) The safety of workers and the general public is paramount.
- 2) An outside contact person is to be provided on each job.
- 3) Safety Data Sheets are to be provided to the Facilities management Personnel for all products to be used on the job. No less than a week's time is required for review by the Safety Staff. The Safety Staff reserves the right to request substitution of the product or process if there is determined to be a risk to employees.
- 4) Copies of all product SDS's are to be maintained on site.
- 5) The general contractor shall assure compliance with all OSHA & PEOSH regulations. New Jersey's Indoor Air Quality Standard Section 12:100-13.5 (N.J.A.C., Chapter 13) is available upon request and Contractors shall be specifically responsible for complying with all other applicable laws, rules and regulations.
- 6) Any disruption in building services, loud noises or excessive dust should be anticipated and addressed prior to the commencement of the specific work involved and the disturbance eliminated or minimized to the maximum extent possible. Notification shall be given to the Owner, STV and Facilities Management one week prior to commencement of such work.
- 7) The general contractor is responsible for good housekeeping on the construction site. All exits and exit ways are to be kept free and clear of material storage, trash and equipment.
- 8) Access to the job site shall be provided to RURCBOG representatives, STV and the Facilities Management staff. RURCBOG employees are not permitted in work areas unless accompanied by an authorized individual. The contractor has the right to restrict access to unauthorized individuals.

- 9) The RURCBOG reserves the right to stop work if an imminent hazard exists. The costs, if any, created by the work stoppage are the responsibility of the general contractor if the general contractor or one of his subcontractors is determined to be responsible for the imminent hazard.

19. **UNDERGROUND FACILITY PROTECTION ACT (N.J.S.A. 48:2-73)**

ONE-CALL is an underground facilities damage prevention system that operates under the direction of the Board of Public Utilities. ONE-CALL maintains membership and service territory data on each operator of an underground facility. Excavators must contact the system prior to excavations and, in turn, ONE-CALL will notify the operators of the planned excavation. Operators must then locate and mark-out all of their facilities.

The attention of bidder is directed to the fact that the contractor is responsible to ascertain the location of any existing utility prior to any excavation work. Before starting any excavation work, the contractor shall contact the underground location service by calling 1-800-272-1000 or 1-908232-9570.

The provisions of any other law, rule, regulation or ordinance to the contrary notwithstanding, any permit or permission for a road opening, building, blasting, demolition or excavation granted by a public entity to an excavator that will result in excavation or demolition activity, shall not be effective until the excavator has notified the One-Call Damage Prevention System pursuant to Section 10 of the Act. This proof may be provided by supplying the public entity with the confirmation number assigned to the notice of intent pursuant to Subsection b. of Section 4 of this Act.

An excavator shall notify the One-Call Damage Prevention System established pursuant to Section 4 of this Act of its intent to engage in excavation or demolition not less than three business days and not more than ten business days prior to the beginning of the excavation or demolition.

A copy of proof of contacting the One-Call Damage Prevention System will be required with any County project that requires any excavation and/or demolition work. This proof shall consist of a verified copy of the One-Call Number issued for the project. This copy with the number must be given to the County department in charge of the project as part of authorization for future payments for the associated project.

**SECTION 00 41 13 - FORM OF PROPOSAL**

To: Rowan University/Rutgers – Camden Board of Governors (Owner)

for: Rowan University/Rutgers – Camden Board of Governors  
Joint Health Sciences Center Café Fitout  
Contract #1: General Construction

Bid Date: April 7, 2020

BASE BID:

1. We, \_\_\_\_\_, the Undersigned, in accordance with the published advertisement inviting proposals, will furnish all labor, material, equipment and services necessary for the complete construction, as defined in the advertisement, specimen contract, specifications, drawings, and proposal, for the Contract amount indicated below for the GENERAL CONSTRUCTION CONSTRUCTION CONTRACT for the ROWAN UNIVERSITY/RUTGERS – CAMDEN BOARD OF GOVERNORS in strict accordance with the Contract Documents and Addenda thereto as prepared by Mckernan Architects for the total sum of:

A: TOTAL LUMP SUM BASE BID:

_____	_____
Written	Figures

B: ALLOWANCE NO. 1: GENERAL ALLOWANCE - **\$10,000.00**

_____	_____
Written	Figures

E: TOTAL BASE BID PLUS ALLOWANCE (A + B = E):

_____	_____
Written	Figures

_____	_____
Written (Add)	Figures (Add)

The Bid will be awarded as follows.

1. Award Total Base Bid Including Allowance No. 1.

2. CHECK LIST FOR BIDDERS:

The following, properly completed, and (where required) signed and sealed, are required to be submitted in quadruplicate with Bid or Bid will be rejected:

See Bidder's Checklist.

A. ALLOWANCES

1. **General Allowance:** The Allowance amounts herein specified are the net amounts available for purchase of materials, including taxes (if any), and the installation/labor cost of any Owner approved changes that will be applied against the allowance amount. The approved amount of each allowance change will be the **net** cost only; insurance, bond, coordination, supervision, project management and overhead/profit are in the contractor's base bid. Changes will be applied to the allowance strictly at the Owner's discretion.

Upon completion of the project, a deduct change order will be issued for all unused allowance amounts.

(Contractor's schedule of values will include a line item for the allowance.)

- B. **AGREEMENT:** We, the Undersigned, agree, if awarded the Contract, to execute an agreement for the above stated work and compensation on the Standard Form of Agreement Between Owner and Contractor, AIA Document A101/CMa Edition and a Waiver of Liens in such form as the Owner will direct.

- C. **SURETY:** We, the Undersigned, agree, if awarded the Contract, to execute and deliver to the Owner, prior to the signing of the Contract, the Performance and Payment Bonds as required by Section 00 21 13 - Instructions to Bidders.

- D. **COMPLETION TIME:** We, the Undersigned, agree, if awarded the Contract, to begin work within 10 days after Notice to Proceed and complete the entire work to the satisfaction of the Owner and the Architect within the time stated below, as applicable.

Refer to Item **15. Time** in Section 002113 – Instructions to Bidders for time of completion.

- E. **LIQUIDATED DAMAGES:** We, the Undersigned, agree, if awarded the Contract, that \$500.00 per day for Interim Milestones and \$1,000 per day for Substantial and Final Completion Milestones. Dates beyond milestone and completion dates as set forth in the schedule provided in Section 002113 will be paid to the Owner for liquidated damages, pursuant to the General Conditions, will be incorporated in the Agreement.

- F. **BID SECURITY:** The attached bid security (10% of bid) is to become the Property of the Owner in the event that the Contract and bond are not executed within the time set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

G. **STATEMENT:**

1. We, the Undersigned, acting through its authorized officers and intending to be legally bound, agree that this bid proposal shall constitute an offer by the Undersigned to enter into a Contract with the acts and things therein provided, which offer shall be irrevocable for sixty (60) calendar days from the date of opening hereof and that the Owner may accept this offer at any time during said period by notifying the Undersigned of the acceptance of said offer.

The undersigned further agrees to comply with the requirements as to conditions of employment, wage rates, and hours of labor set forth in the Contract Documents.

Dated \_\_\_\_\_

Firm Name \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Phone Number \_\_\_\_\_

\*\* If a corporation, give the State of Incorporation, using the phrase:

"A corporation organized under the laws of \_\_\_\_\_."

If a partnership, give names of the partners, using also the phrase:

"Co-partners trading and doing business under the firm name and style of

\_\_\_\_\_

If an individual using a trade name, give individual name, also using the phrase:

"An individual doing business under the firm name and style of \_\_\_\_\_."

Dated:

STATE OF \_\_\_\_\_

SS.

COUNTY OF \_\_\_\_\_

\_\_\_\_\_ being duly sworn say that the several matters stated in this proposal are in all respects true, and that no member of the Rowan University/Rutgers – Camden Board of Governors or employee of the OWNER are interested in any way in this proposal.

Sworn and subscribed before me

\_\_\_\_\_  
Bidder signs above line

this \_\_\_\_\_ day \_\_\_\_\_ 20\_\_\_\_

day of \_\_\_\_\_

\_\_\_\_\_  
Print Name and Title

**SECTION 00 45 18 – HOLD HARMLESS CLAUSE**

HOLD HARMLESS CLAUSE

- A. The contractor shall indemnify and save harmless the Owner, Rowan University/Rutgers – Camden Board of Governors, State of New Jersey, the New Jersey Educational Facilities Authority, the Architect, the Construction Manager, owners consultants, their elected and appointed officers, consultants, agents and employees, including its individual members, from and against all losses, claims, demands, payments, suits, actions, recoveries, and judgments of every nature and description brought against or recoverable from the Owner, their elected and appointed officers, consultants, agents and employees, including its individual members, by reason of any act or omission of the contractor, its agents, employees, assigns, and any entity acting in the contractor’s behalf and on the contractor’s direction in the execution of any work and any activities directly or indirectly incidental thereto. This specifically includes any negligence or carelessness of the contractor in failing to review all plans, specifications, and other documents published by the Owner, their elected and appointed officers, consultants, agents and employees, including their individual members, in connection with the preparation and award of the contract.
  
- B. The contractor shall assume all risk and bear any loss or injury to the property or any person which is caused by the negligence of the contractor, including his negligent failure to notify the Owner, their elected and appointed officers, consultants, agents and employees, including their individual members, or any dangerous condition requiring the Owner, construction manager, their elected and appointed officers, consultants, agents and employees, including their individual members, action, during the period including periods when the contractor is not present on the site but during the progress of the work provided for in the contract until the same shall have been completed and accepted. The contractor shall also assume all responsibility for any and all loss by reason of the contractor’s negligence or violation of any local, state, or federal law, regulation, practice, or order. The contractor shall give to the Owner and all other appropriate authorities all required notices relating to the work for which the contract was let including all notices of any dangerous conditions.
  
- C. The contractor, in executing this Agreement, represents to the Owner, Rowan University/Rutgers – Camden Board of Governors, State of New Jersey, The New Jersey Educational Facilities Authority, and the construction manager, their respective elected and appointed officers, consultants, agents and employees, including their individual members, that the contents of this hold harmless clause has been communicated to any subcontractors or employees and that this representation is made in behalf of both him/herself and all persons or organizations acting in the contractors’ behalf including any subcontractors.

ATTEST: \_\_\_\_\_  
Name of Firm

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Please Print Name

**END OF SECTION 00 45 18**

STATE OF NEW JERSEY )  
 ) SS  
COUNTY OF \_\_\_\_\_)

NO MATERIAL CHANGE OF CIRCUMSTANCES

I, \_\_\_\_\_ being of full age under oath depose and say:

1. I am a(n) owner, partner, shareholder or officer of the company set for below and am duly authorized to execute this affidavit on its behalf.
  
2. A statement as to the financial ability, adequacy of plant and equipment, organization and prior experience of the bidder, as required by N.J.S.A. 40A:11-25 et seq. and N.J.S.A. 18A:18A-32 has been submitted to the Department of Treasury within the last one (1) month preceding the date of opening of bids for this contract.
  
3. I certify that there has been no material adverse change in the qualification except:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(SEAL)

\_\_\_\_\_  
\_\_\_\_\_

Company

Subscribed and sworn to before me this \_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

Notary Public \_\_\_\_\_

My Commission Expires \_\_\_\_\_

(SEAL)

**THIS FORM MUST BE COMPLETE, SIGNED AND SUBMITTED WITH BID**

**STATEMENT OF CORPORATE OWNERSHIP DISCLOSURE**

**(N.J.S.A. 52:25-24.2)**

---

To: Rowan University/Rutgers – Camden Board of Governors

Re: Joint Health Sciences Center – Café Fitout

---

N.J.S.A. 52:25-24.2 provides that no corporation or partnership shall be awarded any State, County, Municipal, or School District contract for the performance of any work or the furnishing of any materials or supplies, unless prior to performing the work or furnishing any materials or supplies, and prior to the receipt of the bid or accompanying the bid of said corporation or partnership, there is submitted a Statement setting forth the names and addresses of all stockholders in the corporation or partnership who own ten percent (10%) or more of its stock of any class, or of all individual partners in the partnership who own a ten percent or greater interest therein. If one or more such stockholder or partner is itself a corporation or partnership, the stockholders holding 10% or more of that corporation's stock, or the individual partners owning 10% or greater interest in that partnership, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every non-corporate stockholder and individual partner, exceeding the 10% ownership criteria established in this act, has been listed.

If addition space is necessary, attach a separate sheet. If there are no owners or partners with 10% or more interest in your company enter "None" below.

Full Corporate Name or Partnership Name or Bidder. \_\_\_\_\_

Shareholders or Partners with 10% Interest or greater:

1. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %  
Address \_\_\_\_\_  
Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_
2. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %  
Address \_\_\_\_\_  
Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_
3. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %  
Address \_\_\_\_\_  
Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_
4. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %  
Address \_\_\_\_\_  
Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



5. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %

Address \_\_\_\_\_

Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

6. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %

Address \_\_\_\_\_

Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

7. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %

Address \_\_\_\_\_

Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

8. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %

Address \_\_\_\_\_

Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

9. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %

Address \_\_\_\_\_

Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

10. Name \_\_\_\_\_ Percentage \_\_\_\_\_ %

Address \_\_\_\_\_

Town \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**Signature of Bidder's Authorized Representative:** \_\_\_\_\_

**Title:** \_\_\_\_\_

**Date:** \_\_\_\_\_

STATE OF NEW JERSEY – LAWS OF 2016 CHAPTER 43, ASSEMBLY NO. 22, Effective August 31, 2016.

1. No corporation or partnership or limited liability companies shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipal or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or accompanying the bid, of said corporation or said partnership, there is submitted a statement setting forth the names and addresses of all stockholders in the corporation or partnership who own ten percent or more of its stock, or any class or of all individual partners in the partnership who own a ten percent or greater interest therein, as the case may be. If one or more such stockholder or partner is itself a corporation or the partnership, the stockholders holding ten percent or more of the corporation's stock, or the individual partners owning ten percent or greater interest in that partnership, as the case may be shall also be listed. The disclosure shall be continued until names and addresses of every non-corporate stockholder, and individual partner, exceeding the ten percent ownership criteria established in this act, has been listed.
2. This act shall take effect immediately

## **CONTRACTOR BUSINESS REGISTRATION CERTIFICATE**

Pursuant to N.J.S.A. 52:32-44 a bidder must be properly registered by the Department of the Treasury, Division of Revenue and a copy of such Registration must be provided prior to the time a contract is awarded or authorized. If subcontractors are named on the bid, proof of the business registration for each must be provided prior to the time a contract is awarded or authorized. Proof of business registration shall be:

- A copy of a Business Registration Certificate issued by the Department of the Treasury, Division of Revenue; or
- A copy of the web version provided by the NJ Division of Revenue, or
- A copy of the Temporary Business Registration Certificate provided by the NJ Division of Revenue, or other sufficient information for the contracting agency to verify proof of registration of the contractor, or named subcontractors, through a computerized system maintained by the State.

Register online at [www.nj.gov/treasury/revenue/taxreg.htm](http://www.nj.gov/treasury/revenue/taxreg.htm). Click the “online” link and then select “Register for Tax and Employer Purposes or call the Division at 609-292-1730.

**Note: A NJ Certificate of Authority is not acceptable.**

### **IN ADDITION:**

The contractor shall provide written notice to all **subcontractors and suppliers** not specifically named on the bid of the responsibility to submit proof of business registration to the contractor. The requirement of proof of business registration extends down through all levels (tiers) of the project.

Before final payment on the contract is made by the contracting agency, the contractor shall submit an accurate list and the proof of business registration of each subcontractor or supplier used in the fulfillment of the contract, or shall attest that no subcontractors were used.


For the term of the contract, the contractor and each of its affiliates and a subcontractor and each of its affiliates [N.J.S.A. 52:32-44(g)(1)] shall collect and remit to the Director, New Jersey Division of Taxation, the use tax due pursuant to the Sales and Use Tax Act on all sales of tangible personal property delivered into this State, regardless of whether the tangible personal property is intended for a contract with a contracting agency.

A business organization that is not able to provide a copy of a business registration as required or that provides false business registration information under the requirements of either of those sections, shall be liable for a penalty of \$25 for each day of violation, not to exceed \$50,000 for each business registration copy not properly provided under a contract with a contracting agency.

## BUSINESS REGISTRATION CERTIFICATE

A contracting agency must receive proof of the bidder's business registration. If subcontractors are named on the bid, proof of the business registration for each must be provided. Proof of business registration shall be:

- A copy of a Business Registration Certificate issued by the Department of Treasury, Division of Revenue; or
- A copy of the web printed version provided by the NJ Division of Revenue



**STATE OF NEW JERSEY  
BUSINESS REGISTRATION CERTIFICATE**

**Taxpayer Name:** TAX REG TEST ACCOUNT

**Trade Name:**

**Address:** 847 ROEBLING AVE  
TRENTON, NJ 08611

**Certificate Number:** 1093907

**Date of Issuance:** October 14, 2004

**For Office Use Only:**  
20041014112823533

ATTACH BRC HERE

## **NOTE: ALL CONTRACTORS**

### **The Public Works Contractor Registration Act** **P.L. 1999,c238**

**Under the Act, no contractor/subcontractor will be permitted to bid on or engage in any contract for public work, as defined in Section 2 of P.L. 1963, c. 150(C: 34:11-56.26), unless that contractor/subcontractor registered with the New Jersey Department of Labor and Workforce Development. The Act provides that upon registration with the Department, a public works contractor/subcontractor will be issued a certificate by the Department indicating compliance with the Act's requirements. The registration fee has been set at \$300.00 per year. Upon effective date of the Act, public bodies will be expected to request production of such a certificate from those bidding on or engaging in public works projects.**

It is important to note that the term "contractor" is defined in the Act as, "a person, partnership, association, joint stock company, trust, corporation or other legal business entity or successor thereof who enters into a contract which is subject to the provision of the "New Jersey Prevailing Wage Act," P.L. 1963, c.150 (C.34:11-56.25, et seq.) and includes any subcontractor or lower tier subcontractor as defined herein."

Registration forms, copies of the Act, and other relevant information is available as of January 2000. To be placed on our mailing list, please contact:

#### Contractor Registration Unit

New Jersey Department of Labor and Workforce Development  
Division of Wage and Hour Compliance  
P. O. Box 389  
Trenton, New Jersey 08625-0389  
Telephone: (609) 292-9464  
Fax: (609) 633-8591  
E-mail: [contreg@dol.state.nj.us](mailto:contreg@dol.state.nj.us)

**As such, any bidder for this project shall submit with their bid or prior to any award, a copy of their certificate of registration for itself and any subcontractors listed, issued by the New Jersey Department of Labor and Workforce Development, Contractor Registration Unit Form that they submitted to the New Jersey Department of Labor and Workforce Development, Contractor Registration Unit, prior to the bid opening date. A copy of the application is not a substitute for the copy of the certificate. Failure to submit this information shall be cause for rejection of your bid.**

**The bidder is responsible for obtaining copies of the certifications from all of the subcontractors for this project.**

**SECTION 00 62 39 – AFFIRMATIVE ACTION REGULATIONS**

**AFFIRMATIVE ACTION REGULATIONS**

**(These forms are enclosed and should be submitted by contractor with proposal)**

(REVISED 4/10)

## **EXHIBIT B**

### **MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE**

**N.J.S.A. 10:5-31 et seq. (P.L. 1975, C. 127)**

**N.J.A.C. 17:27**

### **CONSTRUCTION CONTRACTS**

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, up-grading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Dept. of LWD, Construction EEO Monitoring Program may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B and C, as long as the Dept. of Labor and Workforce Development, Construction

EEO Monitoring Program is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Dept. of Labor and Workforce Development, Construction EEO Monitoring Program, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

(1) To notify the public agency compliance officer, the Dept. of LWD, Construction EEO Monitoring Program, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;

(2) To notify any minority and women workers who have been listed with it as awaiting available vacancies;

(3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;

(4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;



(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contractor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Dept. of LWD, Construction EEO Monitoring Program. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Dept. of LWD, Construction EEO Monitoring Program, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Dept. of LWD, Construction EEO Monitoring Program.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Dept. of LWD, Construction EEO Monitoring Program and submitted promptly to the Dept. of LWD, Construction EEO Monitoring Program upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor

shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an initial project workforce report (Form AA 201) electronically provided to the public agency by the Dept. of LWD, Construction EEO Monitoring Program, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Division and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the-job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or other documents to the Dept. of LWD, Construction EEO Monitoring Program as may be requested by the Dept. of LWD, Construction EEO Monitoring Program from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Dept. of LWD, Construction EEO Monitoring Program for conducting a compliance investigation pursuant to **Subchapter 10 of the Administrative Code (NJAC 17:27)**.

Company \_\_\_\_\_

Contractor Signature \_\_\_\_\_

Date \_\_\_\_\_

END OF SECTION 00 62 39

Rowan University/Rutgers – Camden Board of Governors  
201 S Broadway, Suite 440  
Camden, NJ 08103

**CONTRACTOR(S) - SUBCONTRACTOR(S)**  
**FOR COUNTY OF CAMDEN, STATE OF NEW JERSEY**

As required by law, you must pay prevailing wages. In addition, any sub-contractor you employ must also pay prevailing wages. (N.J.S.A. 34:11-56.25 et seq.) It is your responsibility to make sure your subcontractors are paying prevailing wages.

Camden County has a Wage and Hour Compliance Office. A representative of that office will periodically interview your employees on this project to confirm that they are, in fact, receiving the New Jersey prevailing wages and benefits.

In addition, immediately upon beginning the project, you must provide a certified copy of your weekly/bi-weekly payroll records and your subcontractors. Also your certified payroll must show hourly benefits and gross benefits that are paid each employee as set forth by New Jersey prevailing rates.

Hourly rate  
Total hours  
Hourly benefits  
Gross benefits  
Gross pay

Should any apprentice from another state presently be working in the State of New Jersey, they must now be paid the full journeyman's rate, unless they are a member of a collective bargaining unit whose jurisdiction, according to the agreement, covers territory within New Jersey.

The Wage and Hour Compliance Office is located at the offices of the Camden County Improvement Authority. Payrolls must be sent to the office within ten (10) days of payment of wages.

Should this be a non-union contractual firm, your employees are to receive the New Jersey prevailing rates plus all benefits in their weekly/bi-weekly wages.

Should contractor(s)/subcontractor(s) be from another state, the New Jersey prevailing wage determination and benefits must be paid.

You are to forward to the Office of Wage and Hour Compliance the initial manning report and the Monthly Project Manning Report. Copies to be sent as designated. Failure to comply and submit certified payrolls and manning reports could result in a stop payment order on any monies due. Additionally, any forms to be completed by the primary or subcontractors must be returned to the Office of Wage and Hour Compliance prior to the start of any project.

Signed: \_\_\_\_\_  
(Contractor)

Date: \_\_\_\_\_  
(Contractor T/A)

\_\_\_\_\_  
(Telephone and Address)

\_\_\_\_\_  
(Construction Location)

Please return to New Jersey Wage and Hour Compliance Office, located at:

2220 Voorhees Town Center, Voorhees, NJ 08043, Attention: Wage and Hour Representative. Payrolls must be sent to the office within ten (10) days of payment of wages. This is a State statute.

Failure to comply and submit certified payrolls and manning reports could result in a stop payment of any monies due.

**END OF SECTION 00 73 40**

---

## PREVAILING WAGE COMPLIANCE DECLARATION

---

To: Potential Bidders

Re: Rowan University/Rutgers – Camden Board of Governors  
**JOINT HEALTH SCIENCES CENTER – Café Fit-out PROJECT**

---

The Contractor hereby agrees to comply in all respect with the New Jersey Prevailing Wage Act, N.J.S.A. 34:56.25 et seq.. A copy of the prevailing wage rates pertaining to the work and issued by the New Jersey Department of Labor and Workforce Development entitled, "Prevailing Wage Rate Determination," is included herein. Workers shall be paid not less than the prevailing wage rate. In the event it is found that any worker employed by the Contractor or any Subcontractor covered by the contract herein has been paid a rate of wage less than the prevailing rate required to be paid by such contract, the Owner may terminate the Contractor's or Subcontractor's right to proceed with the work or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise. The Contractor and his sureties shall be liable to the Owner for any excess costs occasioned thereby.

Before final payment is made by or on behalf of the Owner of any sum or sums due top the work, the Contractor or Subcontractor shall file with the Owner, written statements in form satisfactory to the commissioner of Labor and Industry certifying to the amounts then due and owing from such contractor or subcontractor filing such statement to any and all workmen for wages due on account of the work, setting forth therein the names of the persons whose wages are unpaid and the amount due to each respectively which statement shall be certified by the oath of the Contractor or Subcontractor as the case may be in accordance with the said New Jersey Prevailing Wage Act.

The prevailing wage rate shall be determined by the Commissioner of Labor and Industry or his duly authorized deputy or representative.

The undersigned is an (individual) (partnership) (corporation) under the Laws of the State of \_\_\_\_\_ having principal offices at \_\_\_\_\_.

BIDDER \_\_\_\_\_

SIGNATURE \_\_\_\_\_

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

DATE \_\_\_\_\_



# AIA<sup>®</sup> Document G707<sup>™</sup> – 1994

## Consent Of Surety to Final Payment

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

OWNER:

CONTRACT FOR:

ARCHITECT:

TO OWNER: *(Name and address)*

CONTRACT DATED:

CONTRACTOR:

SURETY:

OTHER:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the  
*(Insert name and address of Surety)*

on bond of  
*(Insert name and address of Contractor)*

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety  
of any of its obligations to  
*(Insert name and address of Owner)*

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:  
*(Insert in writing the month followed by the numeric date and year.)*

\_\_\_\_\_  
*(Surety)*

\_\_\_\_\_  
*(Signature of authorized representative)*

Attest:  
*(Seal):*

\_\_\_\_\_  
*(Printed name and title)*

 **AIA**<sup>®</sup> Document A132<sup>™</sup> – 2009

**Standard Form of Agreement Between Owner and Contractor, Construction  
Manager as Adviser Edition**

**AGREEMENT** made as of the    day of    in the year  
*(In words, indicate day, month and year.)*

**BETWEEN** the Owner:  
*(Name, legal status, address and other information)*

and the Contractor:  
*(Name, legal status, address and other information)*

for the following Project:  
*(Name, location and detailed description)*

The Construction Manager:  
*(Name, legal status, address and other information)*

The Architect:  
*(Name, legal status, address and other information)*

The Owner and Contractor agree as follows.

## TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS
- 10 INSURANCE AND BONDS

## EXHIBIT A DETERMINATION OF THE COST OF THE WORK

### ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

### ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

### ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

*(Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)*

If, prior to the commencement of the Work, the Owner requires time to file mortgages, mechanics' liens and other security interests, the Owner's time requirement shall be as follows:

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than ( ) days from the date of commencement, or as follows:

Init.



*(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)*

**Portion of the Work**

**Substantial Completion Date**

, subject to adjustments of this Contract Time as provided in the Contract Documents.

*(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)*

**ARTICLE 4 CONTRACT SUM**

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor’s performance of the Contract. The Contract Sum shall be one of the following:

*(Check the appropriate box.)*

- Stipulated Sum, in accordance with Section 4.2 below
- Cost of the Work plus the Contractor’s Fee without a Guaranteed Maximum Price, in accordance with Section 4.3 below
- Cost of the Work plus the Contractor’s Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

*(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below. Based on the selection above, also complete either Section 5.1.4, 5.1.5 or 5.1.6 below.)*

**§ 4.2 Stipulated Sum**

§ 4.2.1 The Stipulated Sum shall be (\$ ), subject to additions and deletions as provided in the Contract Documents.

§ 4.2.2 The Stipulated Sum is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

*(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)*

**§ 4.2.3 Unit prices, if any:**

*(Identify and state the unit price, and state the quantity limitations, if any, to which the unit price will be applicable.)*

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

**§ 4.2.4 Allowances included in the Stipulated Sum, if any:**

*(Identify allowance and state exclusions, if any, from the allowance price.)*

Item	Allowance
------	-----------

Init.

**§ 4.3 Cost of the Work Plus Contractor's Fee without a Guaranteed Maximum Price**

§ 4.3.1 The Contract Sum is the Cost of the Work as defined in Exhibit A, Determination of the Cost of the Work, plus the Contractor's Fee.

§ 4.3.2 The Contractor's Fee:

*(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)*

§ 4.3.3 The method of adjustment of the Contractor's Fee for changes in the Work:

§ 4.3.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

§ 4.3.5 Rental rates for Contractor-owned equipment shall not exceed percent ( %) of the standard rate paid at the place of the Project.

§ 4.3.6 Unit prices, if any:

*(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)*

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

§ 4.3.7 The Contractor shall prepare and submit to the Construction Manager for the Owner, in writing, a Control Estimate within 14 days of executing this Agreement. The Control Estimate shall include the items in Section A.1 of Exhibit A, Determination of the Cost of the Work.

**§ 4.4 Cost of the Work Plus Contractor's Fee with a Guaranteed Maximum Price**

§ 4.4.1 The Contract Sum is the Cost of the Work as defined in Exhibit A, Determination of the Cost of the Work, plus the Contractor's Fee.

§ 4.4.2 The Contractor's Fee:

*(State a lump sum, percentage of Cost of the Work or other provision for determining the Contractor's Fee.)*

§ 4.4.3 The method of adjustment of the Contractor's Fee for changes in the Work:

§ 4.4.4 Limitations, if any, on a Subcontractor's overhead and profit for increases in the cost of its portion of the Work:

§ 4.4.5 Rental rates for Contractor-owned equipment shall not exceed percent ( %) of the standard rate paid at the place of the Project.

§ 4.4.6 Unit Prices, if any:

*(Identify and state the unit price, and state the quantity limitations, if any, to which the unit price will be applicable.)*

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

Init.



**§ 4.4.7 Guaranteed Maximum Price**

**§ 4.4.7.1** The sum of the Cost of the Work and the Contractor's Fee is guaranteed by the Contractor not to exceed (\$ ), subject to additions and deductions by changes in the Work as provided in the Contract Documents. Such maximum sum is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Contractor without reimbursement by the Owner.

*(Insert specific provisions if the Contractor is to participate in any savings.)*

**§ 4.4.7.2** The Guaranteed Maximum Price is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

**§ 4.4.7.3** Allowances included in the Guaranteed Maximum Price, if any:

*(Identify and state the amounts of any allowances, and state whether they include labor, materials, or both.)*

Item	Allowance
------	-----------

**§ 4.4.7.4** Assumptions, if any, on which the Guaranteed Maximum Price is based:

**ARTICLE 5 PAYMENTS**

**§ 5.1 Progress Payments**

**§ 5.1.1** Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and upon certification of the Project Application and Project Certificate for Payment or Application for Payment and Certificate for Payment by the Construction Manager and Architect and issuance by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

**§ 5.1.2** The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

**§ 5.1.3** Provided that an Application for Payment is received by the Construction Manager not later than the day of a month, the Owner shall make payment of the certified amount in the Application for Payment to the Contractor not later than the day of the month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment shall be made by the Owner not later than ( ) days after the Construction Manager receives the Application for Payment.

*(Federal, state or local laws may require payment within a certain period of time.)*

**§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum**

**§ 5.1.4.1** Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

**§ 5.1.4.2** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.4.3 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of percent ( %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Section 7.3.9 of the General Conditions;
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of percent ( %);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of the General Conditions.

§ 5.1.4.4 The progress payment amount determined in accordance with Section 5.1.4.3 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to percent ( %) of the Contract Sum, less such amounts as the Construction Manager recommends and the Architect determines for incomplete Work and unsettled claims; and
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of the General Conditions.

§ 5.1.4.5 Reduction or limitation of retainage, if any, shall be as follows:

*(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.4.3.1 and 5.1.4.3.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)*

#### § 5.1.5 Progress Payments Where the Contract Sum is Based on the Cost of the Work without a Guaranteed Maximum Price

§ 5.1.5.1 With each Application for Payment, the Contractor shall submit the cost control information required in Exhibit A, Determination of the Cost of the Work, along with payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached and any other evidence required by the Owner, Construction Manager or Architect to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed (1) progress payments already received by the Contractor; less (2) that portion of those payments attributable to the Contractor's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

§ 5.1.5.2 Applications for Payment shall show the Cost of the Work actually incurred by the Contractor through the end of the period covered by the Application for Payment and for which the Contractor has made or intends to make actual payment prior to the next Application for Payment.

§ 5.1.5.3 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take the Cost of the Work as described in Exhibit A, Determination of the Cost of the Work;
- .2 Add the Contractor's Fee, less retainage of percent ( %). The Contractor's Fee shall be computed upon the Cost of the Work described in that Section at the rate stated in that Section; or if the Contractor's Fee is stated as a fixed sum, an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work bears to a reasonable estimate of the probable Cost of the Work upon its completion;
- .3 Subtract retainage of percent ( %) from that portion of the Work that the Contractor self-performs;
- .4 Subtract the aggregate of previous payments made by the Owner;
- .5 Subtract the shortfall, if any, indicated by the Contractor in the documentation required by Article 5 or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and



- .6 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or withdrawn a Certificate for Payment as provided in Section 9.5 of AIA Document A232™–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition.

§ 5.1.5.4 The Owner, Construction Manager and Contractor shall agree upon (1) a mutually acceptable procedure for review and approval of payments to Subcontractors and (2) the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

§ 5.1.5.5 In taking action on the Contractor's Applications for Payment, the Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor and shall not be deemed to represent that the Construction Manager and Architect have made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Article 5 or other supporting data; that the Construction Manager and Architect have made exhaustive or continuous on-site inspections; or that the Construction Manager and Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 5.1.5.6 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

#### § 5.1.6 Progress Payments Where the Contract Sum is Based on the Cost of the Work with a Guaranteed Maximum Price

§ 5.1.6.1 With each Application for Payment, the Contractor shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached, and any other evidence required by the Owner or Architect to demonstrate that cash disbursements already made by the Contractor on account of the Cost of the Work equal or exceed (1) progress payments already received by the Contractor; less (2) that portion of those payments attributable to the Contractor's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

§ 5.1.6.2 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.6.3 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage of completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed; or (2) the percentage obtained by dividing (a) the expense that has actually been incurred by the Contractor on account of that portion of the Work for which the Contractor has made or intends to make actual payment prior to the next Application for Payment by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

§ 5.1.6.4 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage of completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values. Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.10 of AIA Document A232–2009;
- .2 Add that portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work, or if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing;
- .3 Add the Contractor's Fee, less retainage of percent ( %). The Contractor's Fee shall be computed upon the Cost of the Work at the rate stated in Section 4.4.2 or, if the Contractor's Fee is stated as a fixed sum in that Section, shall be an amount that bears the same ratio to that fixed-sum fee as the Cost of the Work bears to a reasonable estimate of the probable Cost of the Work upon its completion;



- .4 Subtract retainage of percent ( %) from that portion of the Work that the Contractor self-performs;
- .5 Subtract the aggregate of previous payments made by the Owner;
- .6 Subtract the shortfall, if any, indicated by the Contractor in the documentation required by Section 5.1.6.1 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's auditors in such documentation; and
- .7 Subtract amounts, if any, for which the Construction Manager or Architect have withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A232–2009.

§ 5.1.6.5 The Owner and the Contractor shall agree upon a (1) mutually acceptable procedure for review and approval of payments to Subcontractors and (2) the percentage of retainage held on Subcontracts, and the Contractor shall execute subcontracts in accordance with those agreements.

§ 5.1.6.6 In taking action on the Contractor's Applications for Payment, the Construction Manager and Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Contractor and shall not be deemed to represent that the Construction Manager or Architect have made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Section 5.1.6.1 or other supporting data; that the Construction Manager or Architect have made exhaustive or continuous on-site inspections; or that the Construction Manager or Architect have made examinations to ascertain how or for what purposes the Contractor has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's auditors acting in the sole interest of the Owner.

§ 5.1.6.7 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

## § 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2 of AIA Document A232–2009, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 the Contractor has submitted a final accounting for the Cost of the Work, pursuant to Exhibit A, Determination of the Cost of the Work when payment is on the basis of the Cost of the Work, with or without a Guaranteed Maximum payment; and
- .3 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment, or as follows:

## ARTICLE 6 DISPUTE RESOLUTION

### § 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A232–2009, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

*(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

### § 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A232–2009, the method of binding dispute resolution shall be as follows:

*(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)*

Init.

[ ] Arbitration pursuant to Section 15.4 of AIA Document A232–2009.

[ ] Litigation in a court of competent jurisdiction.

[ ] Other: *(Specify)*

## ARTICLE 7 TERMINATION OR SUSPENSION

### § 7.1 Where the Contract Sum is a Stipulated Sum

§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2009.

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2009.

### § 7.2 Where the Contract Sum is Based on the Cost of the Work with or without a Guaranteed Maximum Price

§ 7.2.1 Subject to the provisions of Section 7.2.2 below, the Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2009.

§ 7.2.2 The Contract may be terminated by the Owner for cause as provided in Article 14 of AIA Document A232–2009; however, the Owner shall then only pay the Contractor an amount calculated as follows:

- .1 Take the Cost of the Work incurred by the Contractor to the date of termination;
- .2 Add the Contractor's Fee computed upon the Cost of the Work to the date of termination at the rate stated in Sections 4.3.2 or 4.4.2, as applicable, or, if the Contractor's Fee is stated as a fixed sum, an amount that bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion; and
- .3 Subtract the aggregate of previous payments made by the Owner.

§ 7.2.3 If the Owner terminates the Contract for cause when the Contract Sum is based on the Cost of the Work with a Guaranteed Maximum Price, and as provided in Article 14 of AIA Document A232–2009, the amount, if any, to be paid to the Contractor under Section 14.2.4 of AIA Document A232–2009 shall not cause the Guaranteed Maximum Price to be exceeded, nor shall it exceed the amount calculated in Section 7.2.2.

§ 7.2.4 The Owner shall also pay the Contractor fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Contractor that the Owner elects to retain and that is not otherwise included in the Cost of the Work under Section 7.2.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Contractor shall, as a condition of receiving the payments referred to in this Article 7, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Contractor, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Contractor under such subcontracts or purchase orders.

§ 7.2.5 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2009; in such case, the Contract Sum and Contract Time shall be increased as provided in Section 14.3.2 of AIA Document A232–2009, except that the term "profit" shall be understood to mean the Contractor's Fee as described in Sections 4.3.2 and 4.4.2 of this Agreement.

## ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2009 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

*(Insert rate of interest agreed upon, if any.)*

Init.



%

§ 8.3 The Owner’s representative:  
(Name, address and other information)

§ 8.4 The Contractor’s representative:  
(Name, address and other information)

§ 8.5 Neither the Owner’s nor the Contractor’s representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

**ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS**

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A132–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition.

§ 9.1.2 The General Conditions are AIA Document A232–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
----------	-------	------	-------

§ 9.1.4 The Specifications:  
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages
---------	-------	------	-------

§ 9.1.5 The Drawings:  
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)



Number	Title	Date
--------	-------	------

§ 9.1.6 The Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents are:

- .1 AIA Document A132™–2009, Exhibit A, Determination of the Cost of the Work, if applicable.
- .2 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed, or the following:
  
- .3 AIA Document E202™–2008, Building Information Modeling Protocol Exhibit, if completed, or the following:
  
- .4 Other documents, if any, listed below:  
*(List here any additional documents which are intended to form part of the Contract Documents. AIA Document A232–2009 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)*

**ARTICLE 10 INSURANCE AND BONDS**

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A232–2009.

*(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A232–2009.)*

Type of Insurance or Bond	Limit of Liability or Bond Amount (\$0.00)
---------------------------	--

This Agreement is entered into as of the day and year first written above.

\_\_\_\_\_  
**OWNER** *(Signature)*

\_\_\_\_\_  
**CONTRACTOR** *(Signature)*

\_\_\_\_\_  
*(Printed name and title)*

\_\_\_\_\_  
*(Printed name and title)*

# AIA<sup>®</sup> Document A232<sup>™</sup> – 2009

## **General Conditions of the Contract for Construction, Construction Manager as Adviser Edition**

for the following PROJECT:  
*(Name, and location or address)*

THE CONSTRUCTION MANAGER:  
*(Name, legal status and address)*

THE OWNER:  
*(Name, legal status and address)*

THE ARCHITECT:  
*(Name, legal status and address)*

12 UNCOVERING AND  
CORRECTION OF  
WORK

13 MISCELLANEOUS  
PROVISIONS

14 TERMINATION OR  
SUSPENSION OF  
THE CONTRACT

15 CLAIMS AND  
DISPUTES

### TABLE OF ARTICLES

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT AND CONSTRUCTION MANAGER
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY
- 11 INSURANCE AND BONDS

## INDEX

(Topics and numbers in bold are section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, 12.3

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2.1, 3.2.2, 3.3.2, 3.12.8, 3.18, 8.3.1, 9.5.1, 10.1, 10.2.5, 13.4.2, 13.7

Addenda

1.1.1, 3.11, 4.2.14

Additional Costs, Claims for

3.2.4, 3.7.4, 3.7.5, 6.1.1, 7.3, 9.10.3, 9.10.4, 10.3, 10.4, 15.1.4

Additional Inspections and Testing

4.2.8, 12.2.1, 13.5

Additional Insured

11.1.4

Additional Time, Claims for

3.7.4, 3.7.5, 6.1.1, 7.3, 8.3, 10.3

Administration of the Contract

3.10, 4.2

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.19

Allowances

3.8, 7.3.8

All-risk Insurance

11.3.1, 11.3.1.1

Applications for Payment

4.2.7, 4.2.15, 7.3.9, 9.2, 9.3, 9.4, 9.5.1, 9.7, 9.8.3, 9.10.1, 9.10.3, 9.10.5, 11.1.3, 14.2.4

Approvals

2.1.1, 2.2.2, 2.4, 3.1.4, 3.10.1, 3.10.2, 3.12.4 through 3.12.10, 3.13.2, 3.15.2, 4.2.9, 9.3.2, 13.4.2, 13.5

Arbitration

8.3.1, 11.3.10, 13.1, 15.3.2, 15.4

ARCHITECT

4

Architect, Certificates for Payment

9.4

Architect, Definition of

4.1.1

Architect, Extent of Authority

5.2, 7.1.2, 7.3.7, 7.4, 9.3.1, 9.4, 9.5, 9.8.3, 9.8.4, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.5.1, 13.5.2, 15.1.3, 15.2.1

Architect, Limitations of Authority and

Responsibility

2.1.1, 3.12.8, 4.2.1, 4.2.2, 4.2.8, 4.2.13, 5.2.1, 9.6.4, 15.2

Architect's Additional Services and Expenses

2.4, 11.3.1.1, 12.2.1, 12.2.4, 13.5.2

Architect's Administration of the Contract

4.2, 9.4, 9.5, 15.2

Architect's Approvals

3.12.8

Architect's Authority to Reject Work

4.2.8, 12.1.2, 12.2.1

Architect's Copyright

1.5

Architect's Decisions

4.2.8, 7.3.9, 7.4, 8.1.3, 8.3.1, 9.2, 9.4, 9.5, 9.8.3, 9.9.2, 13.5.2, 14.2.2, 14.2.4, 15.2

Architect's Inspections

3.7.4, 4.2, 9.8.3, 9.9.2, 9.10.1, 13.5

Architect's Instructions

3.2.4, 7.4, 9.4

Architect's Interpretations

4.2.8, 4.2.17, 4.2.18

Architect's On-Site Observations

4.2.2, 9.4, 9.5.1, 9.10.1, 12.1.1, 12.1.2, 13.5

Architect's Project Representative

4.2.16

Architect's Relationship with Contractor

1.1.2, 1.5, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.9.2, 3.9.3, 3.10, 3.11, 3.12.8, 3.16, 3.18, 4.2, 5.2, 6.2.2, 8.2, 11.3.7, 12.1, 13.5

Architect's Relationship with Construction Manager

1.1.2, 9.3 through 9.10, 10.3, 13.5.1, 10.3, 11.3.7, 13.4.2, 13.5.4

Architect's Relationship with Subcontractors

1.1.2, 4.2.8, 5.3, 9.6.3, 9.6.4

Architect's Representations

9.4, 9.5, 9.10.1

Architect's Site Visits

4.2.2, 9.4, 9.5.1, 9.8.3, 9.9.2, 9.10.1, 13.5

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.10.2, 10.3.3

Award of Other Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1, 5.2.1, 11.4.1

Binding Dispute Resolution

9.7, 11.3.9, 11.3.10, 13.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.4.1

Boiler and Machinery Insurance

11.3.2



## BONDS, INSURANCE AND

11  
Bonds, Lien  
7.3.7.4, 9.10.3  
Bonds, Performance and Payment  
7.3.7.4, 9.6.7, 9.10.3, 11.3.9, 11.4  
Building Permit  
2.2.2, 3.7.1  
Capitalization  
1.3  
Certificate of Substantial Completion  
9.8.3, 9.8.4, 9.8.5  
Certificates for Payment  
4.2.2, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 15.1.3  
Certificates of Inspection, Testing or Approval  
13.5.4  
Certificates of Insurance  
9.3.2, 9.10.2, 11.1.3  
Change Orders  
1.1.1, 2.4, 3.4.2, 3.7.4, 3.8.2, 3.11, 3.12.8, 4.2.12, 4.2.13, 4.2.14, 5.2.3, 7.1.1, 7.1.2, 7.2, 7.3.2, 7.3.4, 7.3.6, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.3.1.2, 11.3.4, 11.3.9, 12.1.2, 15.1.3  
Change Orders, Definition of  
7.2  
Changes  
7.1  
CHANGES IN THE WORK  
2.2.1, 3.4.2, 3.11, 3.12.8, 4.2.13, 4.2.14, 7, 8.3.1, 9.3.1.1  
Claims, Definition of  
15.1.1  
CLAIMS AND DISPUTES  
1.1.8, 3.2.4, 3.7.5, 6.1.1, 7.3.9, 8.3.2, 9.3.3, 9.10.3, 9.10.4, 10.3.3, 15, 15.4  
Claims for Additional Cost  
3.2.4, 3.7.5, 6.1.1, 7.3.9, 9.10.3, 9.10.4, 10.3.2, 10.4, 15.1.4  
Claims for Additional Time  
3.2.4, 3.7.5, 7, 8.3.2, 10.4, 15.1.5  
Concealed or Unknown Conditions, Claims for  
3.7  
Claims for Damages  
3.2.4, 3.18, 6.1.1, 6.2.5, 8.3.2, 9.3.3, 9.5.1.2, 9.10.2, 9.10.5, 10.3.3, 11.1.1, 11.3.5, 11.3.7, 15.1.6  
Cleaning Up  
3.15, 6.3  
Commencement of Statutory Limitation Period  
13.7  
Commencement of the Work, Definition of  
8.1.2  
Communications, Owner to Architect  
2.2.6  
Communications, Owner to Construction Manager  
2.2.6  
Communications, Owner to Contractor

2.2.6  
Communications Facilitating Contract Administration  
3.9.1, 4.2.6  
COMPLETION, PAYMENTS AND  
9  
Completion, Substantial  
4.2.15, 8.1.1, 8.1.3, 8.2.3, 9.4.3.3, 9.8, 9.9.1, 9.10.3, 12.2.1, 12.2.2, 13.7  
Concealed or Unknown Conditions  
3.7.4, 4.2.8, 8.3.1, 10.3  
Conditions of the Contract  
1.1.1  
Consolidation or Joinder  
15.4.4  
CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS  
1.1.4, 6  
Construction Change Directive, Definition of  
7.3.1  
Construction Change Directives  
1.1.1, 3.4.2, 3.12.8, 4.2.12, 4.2.13, 7.1.1, 7.1.2, 7.1.3, 7.3, 9.3.1.1  
Construction Manager, Building Permits  
2.2.2  
Construction Manager, Communications through  
4.2.6  
Construction Manager, Construction Schedule  
3.10.1, 3.10.3  
CONSTRUCTION MANAGER  
4  
Construction Manager, Definition of  
4.1.2  
Construction Manager, Documents and Samples at the Site  
3.11  
Construction Manager, Extent of Authority  
3.12.7, 3.12.8, 4.1.3, 4.2.1, 4.2.4, 4.2.5, 4.2.9, 7.1.2, 7.2, 7.3.1, 8.3, 9.3.1, 9.4.1, 9.4.2, 9.4.3, 9.8.2, 9.8.3, 9.8.4, 9.9.1, 12.1, 12.2.1, 14.2.2, 14.2.4  
Construction Manager, Limitations of Authority and Responsibility  
4.2.5, 4.2.8, 13.4.2  
Construction Manager, Submittals  
4.2.9  
Construction Manager's Additional Services and Expenses  
12.2.1  
Construction Manager's Administration of the Contract  
4.2, 9.4, 9.5  
Construction Manager's Approval  
2.4, 3.10.1, 3.10.2  
Construction Manager's Authority to Reject Work  
4.2.8, 12.2.1  
Construction Manager's Decisions  
7.3.7, 7.3.9, 9.4.1, 9.5.1

Construction Manager's Inspections  
4.2.8, 9.8.3, 9.9.2

Construction Manager's On-Site Observations  
9.5.1

Construction Manager's Relationship with Architect  
1.1.2, 4.2.1, 4.2.7, 4.2.8, 4.2.9, 4.2.13, 4.2.15, 4.2.16,  
4.2.20, 9.2.1, 9.4.2, 9.5, 9.6.1, 9.6.3, 9.8.2, 9.8.3,  
9.8.4, 9.9.1, 9.10.1, 9.10.2, 9.10.3, 11.1.3, 12.2.4,  
13.5.1, 13.5.2, 13.5.4, 14.2.2, 14.2.4

Construction Manager's Relationship with Contractor  
3.2.2, 3.2.3, 3.3.1, 3.5, 3.10.1, 3.10.2, 3.10.3, 3.11,  
3.12.5, 3.12.6, 3.12.7, 3.12.8, 3.12.9, 3.12.10, 3.13.2,  
3.14.2, 3.15.2, 3.16, 3.17, 3.18.1, 4.2.4, 4.2.5, 4.2.6,  
4.2.9, 4.2.14, 4.2.17, 4.2.20, 5.2, 6.2.1, 6.2.2, 7.1.2,  
7.2, 7.3.5, 7.3.7, 7.3.10, 8.3.1, 9.2, 9.3.1, 9.4.1, 9.4.2,  
9.7, 9.8.2, 9.8.3, 9.8.4, 9.9.1, 9.10.1, 9.10.2, 9.10.3,  
10.1, 10.3, 11.3.7, 12.1, 13.5.1, 13.5.2, 13.5.3, 13.5.4

Construction Manager's Relationship with Owner  
2.2.2, 4.2.1, 10.3.2

Construction Manager's Relationship with Other  
Contractors and Owner's Own Forces  
4.2.4

Construction Manager's Relationship with  
Subcontractors  
4.2.8, 5.3, 9.6.3, 9.6.4

Construction Manager's Site Visits  
9.5.1

Construction Schedules, Contractor's  
3.10, 3.12.1, 3.12.2, 6.1.2, 15.1.5.2

Contingent Assignment of Subcontracts  
5.4, 14.2.2.2

Continuing Contract Performance  
15.1.3

Contract, Definition of  
1.1.2

CONTRACT, TERMINATION OR SUSPENSION  
OF THE  
5.4.1.1, 11.3.9, 14

Contract Administration  
3.1.3, 4.2, 9.4, 9.5

Contract Award and Execution, Conditions Relating  
to  
3.7.1, 3.10, 5.2, 6.1, 11.1.3, 11.3.6, 11.4.1

Contract Documents, Copies Furnished and Use of  
1.5.2, 2.2.5, 5.3

Contract Documents, Definition of  
1.1.1

Contract Performance During Arbitration  
15.1.3

Contract Sum  
3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.2, 7.3, 7.4, 9.1, 9.2,  
9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.3.1.1, 12.3, 14.2.4,  
14.3.2, 15.1.4, 15.2.5

Contract Time  
3.7.4, 3.7.5, 4, 3.10.2, 5.2.3, 7.2.3, 7.3.1, 7.3.5,  
7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7,  
10.3.2, 12.1.1, 14.3.2, 15.1.5.1, 15.2.5

Contract Time, Definition of  
8.1.1

CONTRACTOR  
3

Contractor, Definition of  
3.1.1

Contractor's Construction Schedules  
3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2

Contractor's Employees  
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3,  
11.1.1, 11.3.7, 14.1, 14.2.1.1

Contractor's Liability Insurance  
11.1

Contractor's Relationship with Other Contractors and  
Owner's Own Forces  
3.12.5, 3.14.2, 4.2.6, 6, 11.3, 12.1.2, 12.2.4

Contractor's Relationship with Subcontractors  
1.2.2, 3.3.2, 3.18, 5, 9.6.2, 9.6.7, 9.10.2, 11.3.1.2,  
11.3.7, 11.3.8, 14.2.1.2

Contractor's Relationship with the Architect  
1.1.2, 1.5, 3.2.2, 3.2.3, 3.2.4, 3.4.2, 3.5, 3.7.4, 3.10.1,  
3.11, 3.12, 3.16, 3.18, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3,  
9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3.7, 12, 13.5,  
15.1.2, 15.2.1

Contractor's Relationship with the Construction  
Manager  
1.1.2, 3.2.2, 3.2.3, 3.3.1, 3.5, 3.10.1, 3.10.2, 3.10.3,  
3.11, 3.12.5, 3.12.7, 3.12.9, 3.12.10, 3.13.2, 3.14.2,  
3.15.1, 3.16, 3.17, 3.18.1, 4.2.4, 4.2.5, 5.2, 6.2.1,  
6.2.2, 7.1.2, 7.3.5, 7.3.7, 7.3.10, 8.3.1, 9.2, 9.3.1,  
9.4.1, 9.4.2, 9.8.2, 9.9.1, 9.10.1, 9.10.2, 9.10.3, 10.1,  
10.2.6, 10.3, 11.3.7, 12.1, 13.5.1, 13.5.2, 13.5.3,  
13.5.4

Contractor's Representations  
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor's Responsibility for Those Performing the  
Work  
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor's Review of Contract Documents  
3.2

Contractor's Right to Stop the Work  
9.7

Contractor's Right to Terminate the Contract  
14.1

Contractor's Submittals  
3.10.2, 3.11, 3.12, 4.2.9, 9.2, 9.3, 9.8.2, 9.9.1, 9.10.2,  
9.10.3, 11.1.3, 11.4.2

Contractor's Superintendent  
3.9, 10.2.6

Contractor's Supervision and Construction  
Procedures  
1.2.2, 3.3, 3.4, 4.2.5, 4.2.7, 6.1, 6.2.4, 7.1.3, 7.3.5,  
7.3.7, 8.2, 10, 12, 14, 15.1.3

Contractual Liability Insurance  
11.1.1.8, 11.2, 11.3.1.5

Coordination and Correlation  
1.2, 3.2, 3.3.1, 3.10, 3.12.6, 6.1.2, 6.2.1



Copies Furnished of Drawings and Specifications  
1.5, 2.2.5, 3.11

Copyrights  
1.5, 3.17

Correction of Work  
2.3, 2.4, 9.4.1, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, 12.2

Correlation and Intent of the Contract Documents  
1.2

Costs  
2.4, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.6, 7.3.7, 7.3.8, 7.3.9, 11.3.1.2, 11.3.1.3, 11.3.4, 11.3.9, 12.1, 12.2.1, 13.5, 14

Cutting and Patching  
3.14, 6.2.5

Damage to Construction of Owner or Other Contractors  
3.14.2, 6.2.4, 9.5.1.5, 10.2.1.2, 10.2.5, 10.4, 11.1.1, 11.3, 12.2.4

Damage to the Work  
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 11.3.1, 12.2.4

Damages, Claims for  
3.2.4, 3.18, 6.1.1, 8.3.2, 10.3.3, 11.1.1, 11.3.5, 11.3.7, 14.2.4, 15.1.6

Damages for Delay  
6.1.1, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 15.1.5

Date of Commencement of the Work, Definition of  
8.1.2

Date of Substantial Completion, Definition of  
8.1.3

Day, Definition of  
8.1.4

Decisions of the Architect  
3.7.4, 4.2.7, 4.2.8, 4.2.10, 4.2.11, 4.2.13, 4.2.15, 4.2.16, 4.2.17, 4.2.18, 4.2.19, 4.2.20, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5, 9.8.3, 9.8.4, 9.9.1, 10.1.2, 13.5.2, 14.2.2, 14.2.4, 15.1, 15.2

Decisions of the Construction Manager  
7.3.7, 7.3.8, 7.3.9, 15.1, 15.2

Decisions to Withhold Certification  
9.4.1, 9.5, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance, Rejection and Correction of  
2.3, 2.4, 3.5, 4.2.8, 6.2.5, 9.5.1, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1, 12.2.2

Definitions  
1.1, 2.1.1, 3.1.1, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 4.1.2, 7.2, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time  
3.2, 3.7.4, 5.2.3, 7.2, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.5, 15.2.5

Disputes  
7.3.8, 7.3.9, 9.3, 15.1, 15.2

DISPUTES, CLAIMS AND  
3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 15, 15.4

Documents and Samples at the Site  
3.11

Drawings, Definition of  
1.1.5

Drawings and Specifications, Ownership and Use  
1.1.1, 1.5, 2.2.5, 3.11, 5.3

Duty to Review Contract Documents and Field Conditions  
3.2

Effective Date of Insurance  
8.2.2, 11.1.2

Emergencies  
10.4, 14.1.1.2, 15.1.4

Employees, Contractor's  
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.1, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1

Equipment, Labor, Materials and or  
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12.2, 3.12.3, 3.13.1, 3.15.1, 4.2.8, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.2

Execution and Progress of the Work  
1.1.3, 1.2.1, 1.2.2, 2.2.3, 2.2.5, 3.1, 3.3.1, 3.4.1, 3.5, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.5, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.2, 14.2, 14.3.1, 15.1.3

Extensions of Time  
3.2.4, 3.7.4, 5.2.3, 7.2.3, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.5, 15.2.5

Failure of Payment  
9.5.1.3, 9.7, 13.6, 14.1.1.3, 14.1.3, 14.2.1.2, 15.1.4

Faulty Work (See Defective or Nonconforming Work)

Final Completion and Final Payment  
4.2.1, 4.2.15, 9.8.2, 9.10, 11.1.2, 11.1.3, 11.3.1, 11.3.5, 12.3, 15.2.1

Financial Arrangements, Owner's  
2.2.1

GENERAL PROVISIONS  
1

Governing Law  
13.1

Guarantees (See Warranty and Warranties)

Hazardous Materials  
10.2.4, 10.3

Identification of Contract Documents  
1.2.1

Identification of Subcontractors and Suppliers  
5.2.1

Indemnification  
3.18, 9.10.2, 10.3.3, 10.3.5, 10.3.6, 11.3.1.2, 11.3.7

Information and Services Required of the Owner  
2.1.2, 2.2, 4.2.6, 6.1.2, 6.2.5, 9.6.1, 9.6.4, 9.8, 9.9.1, 9.10.3, 10.3.2, 10.3.3, 11.2, 11.3.4, 13.5.1, 13.5.2, 14.1.1.4, 14.1.3, 15.1.2

Initial Decision  
15.2

Initial Decision Maker, Definition of  
1.1.8

Initial Decision Maker, Extent of Authority  
14.2.2, 14.2.4, 15.1.3, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

3.18.1, 10.2.1, 10.2.2, 10.2.8, 10.3, 10.3.3, 10.4, 11.1.1  
Inspections  
3.1.3, 3.7.1, 4.2.2, 9.8.2, 9.9.2, 9.10.1, 13.5  
Instructions to Bidders  
1.1.1  
Instructions to the Contractor  
3.1.4, 3.3.3, 3.7.1, 4.2.4, 5.2.1, 7, 8.2.2, 12.1, 13.5.2  
Instruments of Service, Definition of  
1.1.7, 1.5, 1.6  
Insurance  
6.1.1, 7.3.7, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, 11  
Insurance, Boiler and Machinery  
11.3.2  
Insurance, Contractor's Liability  
11.1  
Insurance, Effective Date of  
8.2.2, 11.1.2  
Insurance, Loss of Use  
11.3.3  
Insurance, Owner's Liability  
11.2  
Insurance, Property  
10.2.5, 11.3  
Insurance, Stored Materials  
9.3.2, 11.3.1  
INSURANCE AND BONDS  
11  
Insurance Companies, Consent to Partial Occupancy  
9.9.1, 11.3.1.5  
Insurance Companies, Settlement with  
11.3.10  
Intent of the Contract Documents  
1.2, 4.2.18, 4.2.19, 7.4  
Interest  
9.7, 13.6  
Interpretation  
1.4, 4.2.8, 4.2.17, 4.2.18  
Interpretations, Written  
4.2.17, 4.2.18, 4.2.20  
Joinder and Consolidation of Claims Required  
15.4.4  
Judgment on Final Award  
15.4.2  
Labor and Materials, Equipment  
1.1.3, 1.1.6, 3.4, 3.8.2, 3.8.3, 3.12.2, 3.12.3, 3.12.6, 3.12.10, 3.13.1, 3.15.1, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3, 9.5.1.3, 9.6, 9.10.2, 10.2.1.2, 11.3.1, 14.2.1, 14.2.2  
Labor Disputes  
8.3.1  
Laws and Regulations  
3.2.3, 3.2.4, 3.7, 3.13.1, 10.2.2, 10.2.3, 13.5.1, 14.2.1  
Liens  
2.1.2, 9.3.3, 9.10.2, 9.10.4, 15.2.8  
Limitation on Consolidation or Joinder  
15.4.4  
Limitations, Statutes of  
15.4.1  
Limitations of Authority  
3.12.4, 4.1.3, 4.2.16  
Limitations of Liability  
9.6.7, 11.1.1, 12.2  
Limitations of Time  
3.10.1, 4.2.17, 4.2.20, 8.2.1, 9.3.3, 9.6.1, 9.8.4, 9.10.2, 10.2, 11.1.3, 12.1.1, 12.2.2.2, 12.2.5, 13.7, 14.1.1, 15.2.6.1  
Loss of Use Insurance  
11.3.3  
Material Suppliers  
1.5.1, 1.5.2, 3.12, 4.2.6, 4.2.8, 9.3.1, 9.3.1.2, 9.3.3, 9.5.3, 9.6.4, 9.6.5, 9.6.7, 9.10.5, 11.3.1  
Materials, Hazardous  
10.2.4, 10.3  
Materials, Labor, Equipment and  
1.1.3, 1.1.6, 1.5.1, 1.5.2, 3.4, 3.5, 3.8.2, 3.8.3, 3.12.2, 3.12.3, 3.12.6, 3.12.10, 3.13.1, 5.2.1, 6.2.1, 9.3.1, 9.3.2, 9.3.3, 9.5.1, 9.5.3, 9.6.4, 9.6.5, 9.6.7, 9.10.2, 9.10.5, 10.2.1, 10.2.4, 10.3  
Means, Methods, Techniques, Sequences and Procedures of Construction  
3.3.1, 3.12.10, 4.2.5, 4.2.11  
Mechanic's Lien  
2.1.2, 15.2.8  
Mediation  
8.3.1, 10.3.5, 15.2.1, 15.2.5, 15.2.6, 15.3, 15.4.1  
Minor Changes in the Work  
1.1.1, 3.12.8, 4.2.13, 7.1, 7.4  
MISCELLANEOUS PROVISIONS  
13  
Modifications, Definition of  
1.1.1  
Modifications to the Contract  
1.1.1, 1.1.2, 3.11, 4.1.3, 4.2.14, 5.2.3, 7, 11.3.1  
Mutual Responsibility  
6.2  
Nonconforming Work, Acceptance of  
9.4.3, 9.8.3, 12.3  
Nonconforming Work, Rejection and Correction of  
2.3, 2.4, 3.2.3, 3.7.3, 9.4.3.3, 9.8.2, 9.8.3, 9.9.1, 11.1.1, 12.2.2.1, 12.2.3, 12.2.4, 12.2.5  
Notice  
1.5, 2.1.2, 2.2.1, 2.4, 3.2.4, 3.3.1, 3.7.1, 3.7.2, 3.7.5, 3.9.2, 3.12.9, 5.2.1, 6.3, 9.4.1, 9.7, 9.10.1, 9.10.2, 10.2.2, 10.2.6, 10.2.8, 10.3.2, 11.3.6, 12.2.2.1, 13.3, 13.5.1, 13.5.2, 14.1.2, 14.2.2, 14.4.2, 15.1.2, 15.1.4, 15.1.5.1, 15.2, 15.4.1  
Notice of Claims  
3.7.2, 10.2.8, 15.1.2, 15.4.1  
Notice of Testing and Inspections  
13.5.1, 13.5.2  
Notices, Permits, Fees and  
3.7, 7.3.7, 10.2.2



Observations, On-Site  
 3.2.1, 9.5.1, 12.1.1  
 Occupancy  
 2.2.2, 9.6.6, 9.9, 11.3.1.5  
 On-Site Inspections  
 4.2.2, 9.10.1, 9.4.4, 9.5.1  
 Orders, Written  
 4.2.7, 4.2.18, 4.2.20  
 Other Contracts and Contractors  
 1.1.4, 3.14.2, 4.2.9, 6, 11.3.7, 12.1.2  
 OWNER  
 2  
 Owner, Definition of  
 2.1.1  
 Owner, Information and Services Required of the  
 2.1.2, 2.2, 4.2, 6.1.2, 6.1.3, 6.2.5, 9.3.2, 9.6.1, 9.6.4,  
 9.9.2, 9.10.2, 10.3.3, 11.2, 11.3, 13.5.1, 13.5.2,  
 14.1.1, 14.1.3, 15.1.3  
 Owner's Authority  
 1.5, 2.1.1, 2.3, 2.4, 3.4.2, 3.12.10, 3.14.2, 4.1.2, 4.1.3,  
 4.2.8, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2, 7.3.1,  
 8.2.2, 9.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2,  
 11.3.3, 11.3.10, 12.2.2.1, 12.3, 13.5.2, 14.2, 14.3.1,  
 14.4, 15.2.7  
 Owner's Financial Capability  
 2.2.1, 13.2.2, 14.1.1  
 Owner's Liability Insurance  
 11.2  
 Owner's Relationship with Subcontractors  
 1.1.2, 5.2.1, 5.3, 5.4.1, 9.6.4, 9.10.2, 14.2.2  
 Owner's Right to Carry Out the Work  
 2.4, 12.2.4, 14.2.2  
 Owner's Right to Clean Up  
 6.3  
 Owner's Right to Perform Construction with Own  
 Forces and to Award Other Contracts  
 6.1  
 Owner's Right to Stop the Work  
 2.3  
 Owner's Right to Suspend the Work  
 14.3  
 Owner's Right to Terminate the Contract  
 14.2  
 Ownership and Use of Drawings, Specifications and  
 Other Instruments of Service  
 1.1.1, 1.1.5, 1.5, 1.6, 3.11, 3.12.10, 3.17, 4.2.14,  
 4.2.18, 4.2.20  
 Partial Occupancy or Use  
 9.9, 11.3.1.5  
 Patching, Cutting and  
 3.14, 6.2.5  
 Patents and Copyrights, Royalties  
 3.17  
 Payment, Applications for  
 4.2.1, 4.2.7, 4.2.15, 7.3.9, 9.2, 9.3, 9.4, 9.5, 9.7,  
 9.10.1, 9.10.3, 9.10.5, 11.1.3  
 Payment, Certificates for  
 4.2.15, 7.3.9, 9.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1,  
 9.10.3, 14.1.1.3, 15.1.3  
 Payment, Failure of  
 9.4.1, 9.5, 9.7, 14.1.1.3  
 Payment, Final  
 4.2.1, 9.8.2, 9.10, 11.1.2, 11.3.1, 11.3.5, 12.3, 15.2.1  
 Payment Bond, Performance Bond and  
 5.4.1, 7.3.7, 9.6.7, 9.10.2, 9.10.3, 11, 11.4  
 Payments, Progress  
 9.3.1, 9.4.2, 9.6  
 PAYMENTS AND COMPLETION  
 9, 14  
 Payments to Subcontractors  
 5.4.2, 9.3, 9.5.1.3, 9.5.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7,  
 9.10.5, 14.2.1.2  
 PCB  
 10.3.1  
 Performance Bond and Payment Bond  
 5.4.1, 7.3.7, 9.6.7, 9.10.2, 9.10.3, 11, 11.4  
 Permits, Fees, Notices and Compliance with Laws  
 2.2.2, 3.7, 7.3.7.4, 10.2.2  
 PERSONS AND PROPERTY, PROTECTION OF  
 10  
 Polychlorinated Biphenyl  
 10.3.1  
 Product Data, Definition of  
 3.12.2  
 Product Data and Samples, Shop Drawings  
 3.11, 3.12, 4.2.9, 4.2.10, 4.2.14  
 Progress and Completion  
 8.2, 9.3.1, 9.4.2, 9.6, 9.8, 9.10, 14.2.4, 15.1.6  
 Progress Payments  
 9.3.1, 9.4.2, 9.6  
 Project, Definition of  
 1.1.4  
 Project Representatives  
 4.2.16  
 Property Insurance  
 10.2.5, 11.3  
 Project Schedule  
 3.10.1, 3.10.3, 3.10.4, 4.2.2, 4.2.3, 4.2.4  
 PROTECTION OF PERSONS AND PROPERTY  
 10  
 Regulations and Laws  
 1.5, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 4.1.1, 9.6.4, 9.9.1,  
 10.2.2, 11.1, 11.4, 13.1, 13.4, 13.5.1, 13.5.2, 13.6,  
 14.1.1, 14.2.1, 15.2.8, 15.4  
 Rejection of Work  
 3.5, 4.2.8, 12.2.1  
 Releases of and Waivers and of Liens  
 9.10.2  
 Representations  
 1.3, 2.2.1, 3.5, 3.12, 6.2.2, 8.2.1, 9.3.3, 9.4.3, 9.5.1,  
 9.8.2, 9.10.1  
 Representatives  
 2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.1, 4.2.2, 4.2.10, 5.1.1,  
 5.1.2, 13.2.1



Requests for Information  
4.2.20

Resolution of Claims and Disputes  
15

Responsibility for Those Performing the Work  
3.3.2, 3.7.3, 3.12.8, 3.18, 4.2.2, 4.2.5, 4.2.8, 5.3,  
6.1.2, 6.2, 6.3, 9.5.1, 9.8.2, 10

Retainage  
9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

Review of Contract Documents and Field Conditions  
by Contractor  
1.2.2, 3.2, 3.7.3, 3.12.7

Review of Contractor's Submittals by Owner,  
Construction Manager and Architect  
3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 5.2, 9.2, 9.8.2

Review of Shop Drawings, Product Data and  
Samples by Contractor  
3.12.5

Rights and Remedies  
1.1.2, 2.3, 2.4, 3.7.4, 3.15.2, 4.2.8, 5.3, 5.4, 6.1, 6.3,  
7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.2,  
12.2.4, 13.4, 14, 15.4

Royalties, Patents and Copyrights  
3.17

Rules and Notices for Arbitration  
15.4

Safety of Persons and Property  
10.2, 10.3, 10.4

Safety Precautions and Programs  
3.3.1, 3.12, 4.2.5, 5.3, 10.1, 10.2, 10.3, 10.4

Samples, Definition of  
3.12.3

Samples, Shop Drawings, Product Data and  
3.11, 3.12, 4.2.9, 4.2.10

Samples at the Site, Documents and  
3.11

Schedule of Values  
9.2, 9.3.1

Schedules, Construction  
3.10, 3.12.1, 3.12.2, 6.1.2, 15.1.5.2

Separate Contracts and Contractors  
1.1.4, 3.12.5, 3.14.2, 4.2.6, 4.2.11, 6, 8.3.1, 12.1.2

Shop Drawings, Definition of  
3.12.1

Shop Drawings, Product Data and Samples  
3.11, 3.12, 4.2.9, 4.2.10, 4.2.14

Site, Use of  
3.13, 6.1.1, 6.2.1

Site Inspections  
3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2.2, 4.2.3, 4.2.15, 9.4.3.3,  
9.8.3, 9.9.2, 9.10.1, 13.5

Site Visits, Architect's  
3.7.4, 4.2.2, 4.2.15, 9.8.3, 9.9.2, 9.10.1, 13.5

Special Inspections and Testing  
4.2.8, 12.2.1, 13.5

Specifications, Definition of  
1.1.6

Specifications  
1.1.1, 1.1.6, 1.2.2, 1.5, 3.11, 3.12.10, 3.17, 4.2.14

Staffing Plan  
4.2.3

Statute of Limitations  
12.2.5, 13.7, 15.4.1.1

Stopping the Work  
2.3, 9.7, 10.3, 14.1

Stored Materials  
6.2.1, 9.3.2, 10.2.1.2, 10.2.4

Subcontractor, Definition of  
5.1.1

SUBCONTRACTORS  
5

Subcontractors, Work by  
1.2.2, 3.3.2, 3.12.1, 4.2.5, 5.2.3, 5.3, 5.4, 9.3.1.2,  
9.6.7

Subcontractual Relations  
5.3, 5.4, 9.3.1.2, 9.6.2, 9.6.3, 9.10, 10.2.1, 14.1, 14.2

Submittals  
3.2.3, 3.10, 3.11, 3.12, 4.2.9, 4.2.10, 4.2.11, 5.2.1,  
5.2.3, 7.3.7, 9.2, 9.3, 9.8, 9.9.1, 9.10.2, 9.10.3, 11.1.3

Submittal Schedule  
3.10.2, 3.12.5, 4.2.9, 4.2.10

Subrogation, Waivers of  
6.1.1, 11.3.7

Substantial Completion  
8.1.1, 8.1.3, 8.2.3, 9.4.3.3, 9.8, 9.9.1, 9.10.3, 12.2.1,  
12.2.2, 13.7

Substantial Completion, Definition of  
9.8.1

Substitution of Subcontractors  
5.2.3, 5.2.4

Substitution of Architect  
4.1.4

Substitution of Construction Manager  
4.1.4

Substitutions of Materials  
3.4.2, 3.5, 7.3.8

Sub-subcontractor, Definition of  
5.1.2

Subsurface Conditions  
3.7.4

Successors and Assigns  
13.2

Superintendent  
3.9, 10.2.6

Supervision and Construction Procedures  
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.3, 4.2.5, 4.2.8,  
4.2.9, 4.2.10, 4.2.11, 6.1.3, 6.2.4, 7.1.3, 7.3.7, 8.2,  
8.3.1, 9.4.3.3, 10, 12, 14, 15.1.3

Surety  
5.4.1.2, 9.8.5, 9.10.2, 9.10.3, 14.2.2, 15.2.7

Surety, Consent of  
9.10.2, 9.10.3

Surveys  
1.1.7, 2.2.3

Suspension by the Owner for Convenience  
14.3

Suspension of the Work  
5.4.2, 14.3

Suspension or Termination of the Contract  
5.4.1.1, 14

Taxes  
3.6, 3.8.2.1, 7.3.7.4

Termination by the Contractor  
14.1, 15.1.6

Termination by the Owner for Cause  
5.4.1.1, 14.2, 15.1.6

Termination by the Owner for Convenience  
14.4

Termination of the Contractor  
14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT  
14

Tests and Inspections  
3.1.4, 3.3.3, 4.2.2, 4.2.6, 4.2.8, 9.4.3.3, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.5

TIME  
8

Time, Delays and Extensions of  
3.2.4, 3.7.4, 5.2.3, 7.2, 7.3.1, 7.4, 8.3, 9.5.1, 10.3.2, 14.3.2, 15.1.5, 15.2.5

Time Limits  
2.1.2, 2.2, 2.4, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.1, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.4.2, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 11.1.3, 11.4, 12.2, 13.5, 13.7, 14, 15

Time Limits on Claims  
3.7.4, 10.2.8, 13.7, 15.1.2

Title to Work  
9.3.2, 9.3.3

Transmission of Data in Digital Form  
1.6

UNCOVERING AND CORRECTION OF WORK  
12

Uncovering of Work  
12.1

Unforeseen Conditions, Concealed or Unknown  
3.7.4, 8.3.1, 10.3

Unit Prices  
7.3.3.2, 7.3.4

Use of Documents  
1.1.1, 1.5, 2.2.5, 3.12.6, 5.3

Use of Site  
3.13, 6.1.1, 6.2.1

Values, Schedule of  
9.2, 9.3.1

Waiver of Claims by the Architect  
13.4.2

Waiver of Claims by the Construction Manager  
13.4.2

Waiver of Claims by the Contractor  
9.10.5, 13.4.2, 15.1.6

Waiver of Claims by the Owner  
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.4.2, 14.2.4, 15.1.6

Waiver of Consequential Damages  
14.2.4, 15.1.6

Waiver of Liens  
9.10.2, 9.10.4

Waivers of Subrogation  
6.1.1, 11.3.7

Warranty  
3.5, 4.2.15, 9.3.3, 9.8.4, 9.9.1, 9.10.4, 12.2.2

Weather Delays  
15.1.5.2

Work, Definition of  
1.1.3

Written Consent  
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.3, 9.3.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 10.3.2, 11.4.1, 13.2, 13.4.2, 15.4.4.2

Written Interpretations  
4.2.17, 4.2.18

Written Notice  
2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 5.2.1, 5.3, 5.4.1.1, 8.2.2, 9.4, 9.5.1, 9.7, 9.10, 10.2.2, 10.3, 11.1.3, 12.2.2, 12.2.4, 13.3, 13.5.2, 14, 15.4.1

Written Orders  
1.1.1, 2.3, 3.9, 7, 8.2.2, 12.1, 12.2, 13.5.2, 14.3.1, 15.1.2



## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 Basic Definitions

**§ 1.1.1 The Contract Documents.** The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement), and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of addenda relating to bidding requirements).

**§ 1.1.2 The Contract.** The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

**§ 1.1.3 The Work.** The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

**§ 1.1.4 The Project.** The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Multiple Prime Contractors and by the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

**§ 1.1.5 The Drawings.** The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

**§ 1.1.6 The Specifications.** The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

**§ 1.1.7 Instruments of Service.** Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

**§ 1.1.8 Initial Decision Maker.** The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### § 1.2 Correlation and Intent of the Contract Documents

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.



§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### § 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as “all” and “any” and articles such as “the” and “an,” but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service

§ 1.5.1 The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect, or Architect’s consultants’ reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect’s consultants.

### § 1.6 Transmission of Data in Digital Form

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## ARTICLE 2 OWNER

### § 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. Except as otherwise provided in Article 4, the Construction Manager and the Architect do not have such authority. The term “Owner” means the Owner or the Owner’s authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic’s lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner’s interest therein.

### § 2.2 Information and Services Required of the Owner

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or



the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.2** Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit.

**§ 2.2.3** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

**§ 2.2.4** The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.2.5** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

**§ 2.2.6** The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents.

### **§ 2.3 Owner's Right to Stop the Work**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

### **§ 2.4 Owner's Right to Carry Out the Work**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## **ARTICLE 3 CONTRACTOR**

### **§ 3.1 General**

**§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**§ 3.1.2** The plural term "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.



§ 3.1.3 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.4 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

### § 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and Architect any nonconformity discovered by or made known to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### § 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instruction concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner, the Construction Manager, and the Architect and shall not proceed with that portion of the Work without further written instructions from the Architect, through the Construction Manager. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.



§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

#### § 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

#### § 3.5 Warranty

The Contractor warrants to the Owner, Construction Manager, and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform with the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

#### § 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

#### § 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay for other permits, fees, licenses and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect and



Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor in writing, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may proceed as provided in Article 15.

**§ 3.7.5** If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### **§ 3.8 Allowances**

**§ 3.8.1** The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

**§ 3.8.2** Unless otherwise provided in the Contract Documents:

- .1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

**§ 3.8.3** Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### **§ 3.9 Superintendent**

**§ 3.9.1** The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and Architect through the Construction Manager, the name and qualifications of a proposed superintendent. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager, or the Architect has reasonable objection to the proposed superintendent or (2) that any of them require additional time to review. Failure of the Construction Manager to reply within the 14 day period shall constitute notice of no reasonable objection.

**§ 3.9.3** The Contractor shall not employ a proposed superintendent to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### **§ 3.10 Contractor's Construction Schedules**

**§ 3.10.1** The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at



appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project schedule to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors or the construction or operations of the Owner's own forces.

**§ 3.10.2** The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter update it as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Construction Manager's and Architect's approval. The Architect and Construction Manager's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Construction Manager and Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

**§ 3.10.3** The Contractor shall participate with other Contractors, the Construction Manager and Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

**§ 3.10.4** The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project schedule.

### **§ 3.11 Documents and Samples at the Site**

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These documents shall be available to the Architect and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### **§ 3.12 Shop Drawings, Product Data and Samples**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.9 through 4.2.11. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve and submit to the Construction Manager Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the Project submittal schedule approved by the Construction Manager and Architect, or in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Multiple Prime Contractors or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Multiple Prime Contractors.



§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner, Construction Manager, and Architect, that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed and approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Construction Manager and Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 Use of Site

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

### § 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.



§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner's own forces or of other Multiple Prime Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner's own forces or by other Multiple Prime Contractors except with written consent of the Construction Manager, Owner and such other Multiple Prime Contractors; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the other Multiple Prime Contractors or the Owner the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager and Architect access to the Work in preparation and progress wherever located.

### § 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, Construction Manager and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner, Architect, or Construction Manager. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect through the Construction Manager.

### § 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

## ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

### § 4.1 General

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.



§ 4.1.2 The Owner shall retain a construction manager lawfully licensed to practice construction management or an entity lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.3 Duties, responsibilities and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Construction Manager, Architect and Contractor. Consent shall not be unreasonably withheld.

§ 4.1.4 If the employment of the Construction Manager or Architect is terminated, the Owner shall employ a successor construction manager or architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

#### § 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner and Construction Manager (1) known deviations from the Contract Documents and from the most recent Project schedule prepared by the Construction Manager, and (2) defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide a staffing plan to include one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner reasonably informed of the progress of the Work, and will report to the Owner and Architect (1) known deviations from the Contract Documents and the most recent Project schedule, and (2) defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Multiple Prime Contractors in accordance with the latest approved Project schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, or charge of, construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 **Communications Facilitating Contract Administration.** Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Construction Manager, and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Multiple Prime Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces shall be through the Owner.

Init.



§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. The Construction Manager shall determine in general whether the Work of the Contractor is being performed in accordance with the requirements of the Contract Documents and notify the Owner, Contractor and Architect of defects and deficiencies in the Work. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, upon written authorization of the Owner, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data and Samples. Where there are Multiple Prime Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from Contractor and other Multiple Prime Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.10 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.11 Review of the Contractor's submittals by the Construction Manager and Architect is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Construction Manager and Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Construction Manager and Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Construction Manager and Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.12 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.13 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7, and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.14 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples and similar

Init.



required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.2.15 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.16 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.17 The Architect will interpret and decide matters concerning performance under, and requirements of the Contract Documents on written request of the Construction Manager, Owner or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.18 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.2.19 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.20 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing to the Construction Manager to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Multiple Prime Contractors or subcontractors of other Multiple Prime Contractors.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager or the Architect has reasonable objection to any such proposed person or entity or, (2) that the



Construction Manager, Architect or Owner requires additional time for review. Failure of the Construction Manager, Owner, or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution.

### § 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

### § 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. If the Owner assigns the subcontract to a successor Contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor Contractor's obligations under the subcontract.



## ARTICLE 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS

### § 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager, the Owner shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11 and 12.

### § 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Construction Manager and other Multiple Prime Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces or other Multiple Prime Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's own forces or other Multiple Prime Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a separate contractor or to other Multiple Prime Contractors because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces or other Multiple Prime Contractors.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner, separate contractors, or other Multiple Prime Contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and other Multiple Prime Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### § 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, other Multiple Prime Contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Construction Manager, with notice to the Architect, will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.



§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

## § 7.2 Change Orders

A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect and Contractor, stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

## § 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager and Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:



- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Construction Manager and Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### § 7.4 Minor Changes in the Work

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order issued through the Construction Manager and shall be binding on the Owner and Contractor.

### ARTICLE 8 TIME

#### § 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

#### § 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.



### § 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner, Owner's own forces, Construction Manager, Architect, any of the other Multiple Prime Contractors or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration, or by other causes that the Architect, based on the recommendation of the Construction Manager, determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 Contract Sum

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 Schedule of Values

Where the Contract is based on a Stipulated Sum or Guaranteed Maximum Price, the Contractor shall submit to the Construction Manager, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. In the event there is one Contractor, the Construction Manager shall forward to the Architect the Contractor's schedule of values. If there are Multiple Prime Contractors responsible for performing different portions of the Project, the Construction Manager shall forward the Multiple Prime Contractors' schedules of values only if requested by the Architect.

### § 9.3 Applications for Payment

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner, Construction Manager or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Construction Manager and Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for



Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### § 9.4 Certificates for Payment

§ 9.4.1 Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either issue to the Owner a Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there are Multiple Prime Contractors performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives the Multiple Prime Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Multiple Prime Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Multiple Prime Contractors' application with information from similar applications for progress payments from other Multiple Prime Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Multiple Prime Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.3 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

§ 9.4.4 The Construction Manager's certification of an Application for Payment or, in the case of Multiple Prime Contractors, a Project Application and Certificate for Payment shall be based upon the Construction Manager's evaluation of the Work and the information provided as part of the Application for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information and belief, the Work has progressed to the point indicated and the quality of the Work is in accordance with the Contract Documents. The certification will also constitute a recommendation to the Architect and Owner that the Contractor be paid the amount certified.

§ 9.4.5 The Architect's issuance of a Certificate for Payment or in the case of Multiple Prime Contractors, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and information provided as part of the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified.

§ 9.4.6 The representations made pursuant to Sections 9.4.4 and 9.4.5 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Construction Manager or Architect.

§ 9.4.7 The issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques,



sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

### § 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.4 and 9.4.5 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.3. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager and both will reflect such payment on the next Certificate for Payment.

### § 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment or Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Construction Manager and Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner, Construction Manager nor



Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

### § 9.7 Failure of Payment

If the Construction Manager and Architect do not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, within fourteen days after the Construction Manager's receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Construction Manager and Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

### § 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager, and the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the list, which is not sufficiently complete in accordance with the requirements of the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work or designated portion thereof is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.



§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

#### § 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

#### § 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager will evaluate the completion of Work of the Contractor and then forward the notice and Application, with the Construction Manager's recommendations, to the Architect who will promptly make such inspection. When the Architect, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.



§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

### § 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and
- .4 construction or operations by the Owner or other Contractors.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly



employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

**§ 10.2.6** The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner, Construction Manager and Architect.

**§ 10.2.7** The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 Injury or Damage to Person or Property**

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 Hazardous Materials**

**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to, asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing.

**§ 10.3.2** Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resumed upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.



§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

#### § 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

### ARTICLE 11 INSURANCE AND BONDS

#### § 11.1 Contractor's Liability Insurance

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Construction Manager, the Construction Manager's consultants, the Owner, the Architect, and the Architect's

Init.



consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

### § 11.2 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

### § 11.3 Property Insurance

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 **Boiler and Machinery Insurance.** The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 **Loss of Use Insurance.** The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.



§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 **Waivers of Subrogation.** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees each of the other, and (2) the Construction Manager, Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, Owner's separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or distribution of insurance proceeds in accordance with the direction of the arbitrators.



#### § 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

### ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

#### § 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their observation and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

#### § 12.2 Correction of Work

##### § 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

##### § 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors or other Multiple Prime Contractors caused by the



Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### **§ 12.3 Acceptance of Nonconforming Work**

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 Governing Law**

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### **§ 13.2 Successors and Assigns**

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**§ 13.2.2** The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

### **§ 13.3 Written Notice**

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity or to an officer of the corporation for which it was intended; or if delivered at or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### **§ 13.4 Rights and Remedies**

**§ 13.4.1** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

**§ 13.4.2** No action or failure to act by the Owner, Construction Manager, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

### **§ 13.5 Tests and Inspections**

**§ 13.5.1** Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and



(2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

§ 13.5.5 If the Construction Manager or Architect is to observe tests, inspections or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

#### § 13.7 Time Limits on Claims

The Owner and the Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and the Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

### ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### § 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.



§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

#### § 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, after consultation with the Construction Manager, and upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

#### § 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and the Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:



- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of this Contract.

#### **§ 14.4 Termination by the Owner for Convenience**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

### **ARTICLE 15 CLAIMS AND DISPUTES**

#### **§ 15.1 Claims**

**§ 15.1.1 Definition.** A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

**§ 15.1.2 Notice of Claims.** Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect, if the Construction Manager and or Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

**§ 15.1.3 Continuing Contract Performance.** Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Construction Manager will prepare Change Orders and the Architect will issue a Certificate for Payment or Project Certificate for Payment in accordance with the decisions of the Initial Decision Maker.

**§ 15.1.4 Claims for Additional Cost.** If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3.

#### **§ 15.1.5 Claims for Additional Time**

**§ 15.1.5.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

**§ 15.1.5.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

**§ 15.1.6 Claims for Consequential Damages.** The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and



- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

## § 15.2 Initial Decision

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect and Construction Manager, if the Architect or Construction Manager is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

Init.



### § 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

### § 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

### § 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.



# AIA<sup>®</sup> Document G706A<sup>™</sup> – 1994

## Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT  
NUMBER:

OWNER:

ARCHITECT:

TO OWNER: *(Name and address)*

CONTRACT FOR:  
CONTRACT DATED:

CONTRACTOR:

SURETY:

OTHER:

STATE OF:  
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

### EXCEPTIONS:

#### SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

\_\_\_\_\_  
*(Signature of authorized representative)*

\_\_\_\_\_  
*(Printed name and title)*

Subscribed and sworn to before me on this date:

Notary Public:  
My Commission Expires:

SECTION 011000 - SUMMARY

1.1 PROJECT INFORMATION

- A. Project Identification: Café Fitout for the Rowan University-Rutgers Camden Joint Health Sciences Center.
  - 1. Project Location: 201 S. Broadway, Camden, New Jersey.
- B. Owner: Rowan University-Rutgers Camden Board of Governors.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Scope of the Project: The project consists of the interior fitout of the existing ground floor space set aside for use as a Café.
- B. The scope of work consists of all labor, materials, equipment, and means to finish the interior of the Café space within the existing building as indicated. Prior to bidding, the contractor is to inspect the building site to become familiar with all conditions.
- C. The work is to be bid as a single prime contract. The Contractor will be responsible for any required licenses, fees, inspections and permits and for complying with any federal, state and municipal laws and regulations applicable to the performance of the work.

1.3 WORK UNDER OTHER CONTRACTS

- A. The Joint Health Sciences Building is a newly constructed facility that was dedicated on October 15, 2019. The final stages of construction, other than the Café Fitout, should be completely done by the start of the fitout work. However there may be occasions where the original building contractor is on site for service or warranty items.
- B. The Owner may elect to do additional work beyond the scope of these documents with separate contractors or their own employees.
- C. The successful bidders will cooperate fully with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.4 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall be restricted to areas of work only. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

END OF SECTION 011000

## SECTION 012100 – ALLOWANCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
  - 1. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Modification Procedures" specifies procedures for submitting and handling Change Orders.

#### 1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by the Architect from the designated supplier.

#### 1.4 SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

#### 1.5 SCHEDULE OF ALLOWANCES

**Note: All allowance amounts will be included in the contractors Base Bid, the allowance amounts will be used as indicated for the building being renovated under the scope of work.**

A prior approval and written authorization is required from the Owner and McKernan Architects prior to using any of the amounts listed in this section.

*Failure to comply with the requirements in this section may result in the refusal to make compensation for completion of unauthorized work.*

- A. Allowance No. 1: General Allowance. Include a **\$10,000** lump sum allowance is to be included in the total price bid that is intended to be used if and where directed for unforeseen work associated with the project, throughout the course of construction.
- B. At Project closeout, credit unused amounts remaining in the allowances to the Owner by Change Order.

END OF SECTION 012100



## SECTION 012500 – SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.
  - 2. Division 1 Section "Materials and Equipment" specifies requirements governing the Contractor's selection of products and product options.

#### 1.3 SUBMITTALS

- A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
  - 1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
  - 2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
  - 3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
    - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
    - b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
    - c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
    - d. Samples, where applicable or requested.
    - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
    - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
    - g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
    - h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
  1. Extensive revisions to the Contract Documents are not required.
  2. Proposed changes are in keeping with the general intent of the Contract Documents.
  3. The request is timely, fully documented, and properly submitted.
  4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
  6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
  7. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.
- B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012500

## SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
  - 2. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
  - 3. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

#### 1.3 MINOR CHANGES IN THE WORK

- A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

#### 1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
  - 2. Within 7 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
    - a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Construction Manager and Architect. Request should include any changes to the project schedule.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
  2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Unless otherwise waived, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests or Owner's Forms, if applicable.

#### 1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

#### 1.6 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701CMA.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012600



## SECTION 012900 – PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
  - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

#### 1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    - a. Contractor's Construction Schedule.
    - b. Application for Payment forms, including Continuation Sheets.
    - c. List of subcontractors.
    - d. List of products.
    - e. List of principal suppliers and fabricators.
    - f. Schedule of submittals.
  - 2. Submit the Schedule of Values to the Construction Manager and Architect at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Construction Manager.
    - c. Name of the Architect.
    - d. Project number.
    - e. Contractor's name and address.
    - f. Date of submittal.
  - 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.

- b. Description of Work.
- c. Change Orders (numbers) that affect value.
- d. Dollar value.
  - 1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
- 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
- 4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
- 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
- 6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Construction Manager and Architect and paid for by the Owner.
  - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment-Application Forms: Use AIA Document G702CMA and Continuation Sheets G703 as the form for Applications for Payment or forms provided by the Owner
- D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Construction Manager and/or Architect will return incomplete applications without action.
  - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit four (4) signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
  - 1. Send a complete copy of Application for Payment to the Construction Manager at the same time.
  - 2. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

3. Submit Draft, pencil review copy five (5) days before due date to CM.
- F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors and suppliers for the construction period covered by the previous application.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.
  3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
    - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- G. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
1. List of subcontractors.
  2. List of principal suppliers and fabricators.
  3. Schedule of Values.
  4. Contractor's Construction Schedule (preliminary if not final).
  5. Schedule of principal products.
  6. Submittal Schedule (preliminary if not final).
  7. Copies of building permits.
  8. Copies of authorizations and licenses from governing authorities for performance of the Work.
  9. Initial progress report.
  10. Certificates of insurance and insurance policies.
  11. Performance and payment bonds.
  12. Data needed to acquire the Owner's insurance.
  13. Initial settlement survey and damage report, if required.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
  2. Administrative actions and submittals that shall precede or coincide with this application include:
    - a. Occupancy permits and similar approvals.
    - b. Warranties (guarantees) and maintenance agreements.
    - c. Test/adjust/balance records.
    - d. Maintenance instructions.
    - e. Meter readings.
    - f. Startup performance reports.
    - g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
    - h. Final cleaning.
    - i. Application for reduction of retainage and consent of surety.
    - j. Advice on shifting insurance coverages.
    - k. Final progress photographs.

- l. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
  - m. Change of door locks to Owner's access.
  
- I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
  - 1. Completion of Project closeout requirements.
  - 2. Completion of items specified for completion after Substantial Completion.
  - 3. Ensure that unsettled claims will be settled.
  - 4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
  - 5. Transmittal of required Project construction records to the Owner.
  - 6. Certified property survey.
  - 7. Proof that taxes, fees, and similar obligations were paid.
  - 8. Removal of temporary facilities and services.
  - 9. Removal of surplus materials, rubbish, and similar elements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012900



## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Project meetings.
- B. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.

#### 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
- 1.6 REQUEST FOR INFORMATION (RFI)
- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect and Construction Manager.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Field dimensions and conditions, as appropriate.
  9. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  10. Contractor's signature.
  11. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 5 business days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect and Construction Manager.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's and Construction Manager's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven business days if Contractor disagrees with response.
- 1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.

2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement in the form of an Agreement form acceptable to Owner and Architect.

B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days from the Notice to Proceed.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
  - a. Responsibilities and personnel assignments.
  - b. Tentative construction schedule.
  - c. Phasing.
  - d. Critical work sequencing and long lead items.
  - e. Designation of key personnel and their duties.
  - f. Lines of communications.
  - g. Use of web-based Project software.
  - h. Procedures for processing field decisions and Change Orders.
  - i. Procedures for RFIs.
  - j. Procedures for testing and inspecting.
  - k. Procedures for processing Applications for Payment.
  - l. Distribution of the Contract Documents.
  - m. Submittal procedures.
  - n. Sustainable design requirements.
  - o. Preparation of Record Documents.
  - p. Use of the premises.
  - q. Work restrictions.
  - r. Working hours.
  - s. Owner's occupancy requirements.
  - t. Responsibility for temporary facilities and controls.
  - u. Procedures for moisture and mold control.



- v. Procedures for disruptions and shutdowns.
  - w. Construction waste management and recycling.
  - x. Parking availability.
  - y. Office, work, and storage areas.
  - z. Equipment deliveries and priorities.
  - aa. First aid.
  - bb. Security.
  - cc. Progress cleaning.
3. Minutes: The Construction Manager will record and distribute the meeting minutes to each party present and to parties requiring information.
- C. Progress Meetings: Construction Manager will conduct progress meetings at regular intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
  - 4. Minutes: The Construction Manager will record and distribute the meeting minutes to each party present and to parties requiring information.
    - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Startup construction schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Construction schedule updating reports.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Site condition reports.
  - 7. Unusual event reports.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file, where indicated.
  - 2. PDF file.
- B. Startup construction schedule.
  - 1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
  - 3. Total Float Report: List of activities sorted in ascending order of total float.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Unusual Event Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

#### 1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

#### 1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

#### 1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
  1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Contractor shall submit the qualifications of the in-house personnel for approval prior to commencing work.
  2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
  1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
  2. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
  4. Punch List and Final Completion: Include not more than 10 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
  1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner that may affect the Contractor's scope of work.
  2. Work by Others: Include a separate activity for each portion of the Work performed by Others that may affect the Contractor's scope of work.
  3. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Provisions for future construction.
    - c. Seasonal variations.
    - d. Environmental control.
  4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Fabrication.
    - d. Sample testing.
    - e. Deliveries.
    - f. Installation.
    - g. Tests and inspections.



- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
  - F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. For each line item, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
    - 1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
  - G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
    - 1. Unresolved issues.
    - 2. Unanswered Requests for Information.
    - 3. Rejected or unreturned submittals.
    - 4. Notations on returned submittals.
    - 5. Pending modifications affecting the Work and the Contract Time.
  - H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
    - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
    - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
    - 3. As the Work progresses, indicate final completion percentage for each activity.
  - I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the original approved schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
  - J. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
    - 1. Post copies in Project meeting rooms and temporary field offices.
    - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
- 1.8 REPORTS
- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
    - 1. List of subcontractors at Project site.
    - 2. List of separate contractors at Project site.
    - 3. Approximate count of personnel at Project site.
    - 4. Equipment at Project site.
    - 5. Material deliveries.
    - 6. High and low temperatures and general weather conditions, including presence of rain or snow.

7. Testing and inspection.
  8. Accidents.
  9. Meetings and significant decisions.
  10. Unusual events.
  11. Stoppages, delays, shortages, and losses.
  12. Meter readings and similar recordings.
  13. Emergency procedures.
  14. Orders and requests of authorities having jurisdiction.
  15. Change Orders received and implemented.
  16. Construction Change Directives received and implemented.
  17. Equipment or system tests and startups.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report to the Architect, Construction Manager, and Owner; along with a Request for Information, as required. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- C. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit Unusual Event Reports directly to Construction Manager within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

## SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final Completion construction photographs.

#### 1.3 SUBMITTALS

- A. Qualification Data: Provide information regarding photographer's experience.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include the same label information as the corresponding set of photographs.
- C. Construction Photographs: Submit digital images of each photographic view within seven days of taking photographs.
  - 1. Digital Images: Submit a complete set of digital image electronic files with each submittal. Identify electronic media with date photographs were taken.

#### 1.4 COORDINATION

- A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

#### 1.5 USAGE RIGHTS

- A. Digital Images: Obtain and transfer copyright usage rights from photographer to Owner and his consultants for unlimited reproduction of photographic documentation.

### PART 2 - PRODUCTS

#### 2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPEG format, with minimum sensor size of 5.0 megapixels.

PART 3 - EXECUTION

3.1 PHOTOGRAPHS, GENERAL

- A. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- B. Field Office Copies: Retain one set of digital copies of progress photographs in the field office at Project site, available at all times for reference. Identify photographs the same as for those submitted to Architect and Construction Manager.

3.2 CONSTRUCTION PHOTOGRAPHS

- A. Preconstruction Photographs: Before starting construction, take digital photographs of Project site and surrounding properties from different vantage points, as directed by Architect or Construction Manager.
  - 1. Take a minimum of 10 photographs to show existing conditions adjacent to the property before starting the Work.
  - 2. Take a minimum of 10 photographs of existing buildings either on or adjoining the property to accurately record the physical conditions at the start of construction.
- B. Final Completion Construction Photographs: Take a minimum of 10 digital photographs after date of Substantial Completion for submission as Project Record Documents. Architect or Construction Manager will direct photographer for desired vantage points.
- C. Final Completion Construction Photographs: Take a minimum of 10 digital photographs after date of Substantial Completion for submission as Project Record Documents. Architect or Construction Manager will direct photographer for desired vantage points.
- D. Additional Photographs: Architect or Construction Manager may issue requests for additional photographs, in addition to progress photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
  - 1. Photographer will be given three days' notice, where feasible.
  - 2. In emergency situations, photographer shall take additional photographs within 24 hours of request.
  - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Special events planned at Project site.
    - b. Immediate follow-up when on-site events result in construction damage or losses.
    - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    - d. Substantial Completion of a major phase or component of the Work.
    - e. Extra record photographs at time of final acceptance.
    - f. Owner's request for special publicity photographs.
  - 4. Show existing buildings either on or adjoining Project site to accurately record the physical conditions at the start of construction.
  - 5. Show protection efforts by Contractor.

END OF SECTION 013233



## SECTION 013300 – SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

- 1. Action Submittals:

- a. Contractor's Construction Schedule
- b. Product Data.
- c. Shop Drawings.
- d. Samples.
- e. Product Schedule or List.
- f. Subcontract List.

- 2. Informational Submittals:

- a. Certifications.
- b. Test Reports.
- c. Maintenance Data.
- d. Design Data.
- e. Manufacturer's Instructions.
- f. Manufacturer's Field Reports.
- g. Insurance Certificates and Bonds.
- h. Material Safety Data Sheets.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

- 1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
- 2. Division 1 Section "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
- 3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
- 4. Division 1 Section "Quality Control" specifies requirements for submittal of inspection and test reports.
- 5. Division 1 Section "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.
- 6. Division 1 Section "Electronic Data Transfer Agreement" for requirements for access to Architects electronic files.

### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action.
- B. Informational Submittals: Written information that does not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

### 1.4 SUBMITTAL PROCEDURES

- A. General:
  - 1. Submittals shall be neat and legible, of uniform scale, responsive to requirements, with all sheets of similar information of same size.
  - 2. Electronic copies of CAD Drawings of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals, subject to the requirements of the Architect's or Engineer's "Electronic Data Transfer Agreement."
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Retain subparagraph below where one submittal has an impact on another.
  - 3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
    - b. Package submittals to cover complete assemblies or systems. Partial or incomplete submittals will be returned rejected without review.
  - 4. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
- C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Each copy of the submittal is to have a complete submittal data sheet, form is attached.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect and Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  - 4. Shop Drawings: Ten (10) consecutive working days will be required for the review of any shop drawings and other submittals requiring review by the Architect if received in quantity equal to or less than fifty (50) sheets during five (5) consecutive working days. For each sheet or other item in excess of over fifty (50) sheets received in five (5) consecutive working days, additional time will be required for review time. The Architect will advise the Contractor of additional time required.

5. Allow 15 consecutive working days for processing each resubmittal.
  6. No extension of the Contract Time will be authorized because of:
    - a. Failure to comply with approved Submittal Schedule.
    - b. Failure to transmit submittals enough in advance of the Work to permit processing.
- E. The Architect will review the submittals on shop drawings, product data and samples and one (1) resubmittal.
1. For submittals in excess of the one (1) resubmittal, the Contractor shall reimburse the Owner for additional services required of the Construction Manager, the Architect, and/or the Architect's consultant by these additional resubmittals.
  2. No additional time will be allowed the Contractor for delays caused by excess number of resubmittals.

## 1.5 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies:
    - a. Product Data: Submit electronic copies of each required submittal to the Architect and submit a copy to the Construction Manager. The Architect will review and will return a copy marked with action taken and corrections or modifications required.
    - b. Shop Drawings: Submit one electronic copy in PDF format for the Architect's review submit a copy to the Construction Manager; a reviewed copy will be returned electronically.
    - c. Samples – When required by individual Specification Sections:
      - 1) Submit one (1) sample of standard manufactured items, and for initial selection of colors and finishes.
      - 2) Submit two (2) samples for custom fabricated items.
      - 3) When color/finish sample is approved, furnish one (1) additional sample of approved color/finish for Architect's use.
      - 4) One of the custom fabricated samples will be returned with the Architect's comments.
- B. Contractor's Construction Schedule
1. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after the date established for "Commencement of the Work."
    - a. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
    - b. Revise percentage increments and time requirements below to suit Project.
    - c. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
    - d. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
    - e. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
  2. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.

3. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
4. Schedule Updating: Revise the schedule monthly and after each event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting and issue report on progress of all Prime Contractors progress.

C. Shop Drawings:

1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings, unless submittal of Architect's CAD Drawings are otherwise permitted.
  - a. Standard information prepared without specific reference to the Project is not a Shop Drawing.
  - b. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
    - 1) Dimensions.
    - 2) Identification of products.
    - 3) Fabrication and installation drawings.
    - 4) Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - 5) Templates and patterns.
    - 6) Schedules.
    - 7) Design calculations.
    - 8) Compliance with specified standards.
    - 9) Notation of coordination requirements.
    - 10) Notation of dimensions established by field measurement.
    - 11) Relationship to adjoining construction clearly indicated.
    - 12) Seal and signature of professional engineer if specified.
    - 13) Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
    - 14) All deviations, from the Contract Documents, clearly indicated.
  - c. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
  - d. Deviations from Contract Documents require specific written acceptance by the Architect of the noted deviation and clear indication on the submittal.

D. Product Data

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
  - a. Mark each copy to show applicable choices and options. Where Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    - 1) Manufacturer's recommendations.
    - 2) Compliance with trade association standards.
    - 3) Compliance with recognized testing agency standards.
    - 4) Application of testing agency labels and seals.
    - 5) Notation of dimensions verified by field measurement.
    - 6) Notation of coordination requirements.

- b. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

E. Samples

1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
  - a. Include identification on each sample with full project identification.
  - b. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
2. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

F. Quality Assurance Submittals

1. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
2. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.6 Informational Submittals

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit electronic copies of each submittal, unless otherwise indicated. Architect and Construction Manager will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Coordination."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.



- G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- L. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Control."
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

- R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
  2. Required substrate tolerances.
  3. Sequence of installation or erection.
  4. Required installation tolerances.
  5. Required adjustments.
  6. Recommendations for cleaning and protection.
- S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- U. Construction Photographs: Comply with requirements specified in Division 01 Section "Photographic Documentation."
- V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect, except as required in "Action Submittals" Article.

Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. The General Contractor shall process all submittals from all prime contractors through a single coordinated numbering system and tracking log; with Specification Section title and number. The General Contractor shall submit all submissions to the Architect with a copy to the Construction Manager.
- B. The General Contractor shall review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note: Corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S / ACTION

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it.
  - 1. Submittals will be reviewed for architectural design conformity and general conformance with the Contract Documents only. The Contractor is responsible for confirming and correlating dimensions at job sites for tolerances, clearances, quantities, fabrication processes and techniques of construction, coordination of their Work with other trades and full compliance with the Contract Documents.
  - 2. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:
    - a. Approved: The Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
    - b. Approved as Noted: The Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
    - c. Revise as Noted and Resubmit: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
    - d. Rejected/Resubmit as Specified: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. The work covered by the submittal does not conform to the design concept or meet the contract document requirement.
    - e. Reviewed: Where a submittal is the responsibility of a consultant to the Architect the Architect's stamp will indicate that the submittal has been reviewed by the Architect for design intent. The Architect's consultant shall stamp the submittal with an appropriate action stamp the will define the action to be taken by the Contractor.
    - f. No Action Required: Submittal is for information or record purposes or special processing or other activity. The submittal will not be returned and the Contractor will be so notified.
- C. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- D. Unsolicited Submittals: Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Cutting and Patching" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

#### 1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Each Prime Contractor shall employ and pay a testing agency selected by the Prime Contractor and approved by the Owner and the architect to perform inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
- B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
- C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
  1. Provide access to the Work.
  2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
  3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
  4. Provide facilities for storage and curing of test samples.
  5. Deliver samples to testing laboratories.
  6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  7. Provide security and protection of samples and test equipment at the Project Site.
- D. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
  1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
- E. All testing agencies are to provide daily field reports each day inspectors are on site. The Contractor shall provide copies of all Inspection Reports to the Construction Manager at the end of each work day. Each report shall state all activities that were tested and must report that the tests did or did not meet all specification requirements. The report must state if additional tests are required due to continued operations or if tests did not meet the required specifications. The report must state if tests completed that day are repeat tests on activity that were previously tested.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014000



## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Water service and distribution.
  - 2. Temporary electric power and light.
  - 3. Sanitary facilities, including drinking water.
- C. Support facilities include, but are not limited to, the following:
  - 1. Temporary enclosures.
  - 2. Temporary project identification signs.
  - 3. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Temporary fire protection.
  - 2. Barricades, warning signs, and lights.
  - 3. Environmental protection.

#### 1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
  - 1. Building code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Environmental protection regulations.
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- C. Lamps and Light Fixtures: Provide general service lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- D. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

## PART 3 - EXECUTION

### 3.1 TEMPORARY UTILITY INSTALLATION

- A. General: Contractor may use the existing building services for this project.
- B. Water Service: Contractor may use the existing water service.
- C. Temporary Electric Power Service: Contractor may use the existing electrical outlets for electrical work.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
  - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
- F. Toilets: Contractor may use the existing adjacent toilet room for temporary facilities..

### 3.2 SUPPORT FACILITIES INSTALLATION

- A. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of

unauthorized signs. Provide identification sign with names of schools, Board of Governors, General Contractor and other names as requested.

- B. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Separate and recycle metals, glass, plastics, clean paper and building materials. Dispose of material lawfully.

### 3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
  - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
  - 2. Store combustible materials in containers in fire-safe locations.
  - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
  - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- B. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- C. Security Enclosure and Lockup: Contractor to maintain security of the existing building at all times.
  - 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- D. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may

have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
  - a. Replace air filters and clean inside of ductwork and housings.
  - b. Replace significantly worn parts and parts subject to unusual operating conditions.
  - c. Replace lamps burned out or noticeably dimmed by hours of use.

### 3.5 PROTECTION OF EXISTING BUILDING

- A. Contractor to protect existing facility and all finishes during the course of the project. Protect all walls, floors, doors etc., including wood panels and terrazzo floor, from damage and repair any damage that may occur, to the Owner's satisfaction.

END OF SECTION 015000

## SECTION 016000 – PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule.
  - 2. Division 1 Section "Substitutions" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

#### 1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
  - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
  - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.



## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
  - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
  - 2. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 3. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 4. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, new at the time of installation.
  - 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
  - 1. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.
  - 2. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

END OF SECTION 016000

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

- B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

#### 1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
  1. Prior to submitting cutting and patching plan or commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
    - a. Contractor's superintendent.

- b. Trade supervisor responsible for cutting operations.
  - c. Trade supervisor(s) responsible for patching of each type of substrate.
  - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
  1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
  2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  3. Products: List products to be used for patching and firms or entities that will perform patching work.
  4. Dates: Indicate when cutting and patching will be performed.
  5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

#### 1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.
  3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.
    - f. Piping, ductwork, vessels, and equipment.
    - g. Noise- and vibration-control elements and systems.
  4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
  1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.



- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager immediately.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

### 3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points immediately. Base replacements on the original survey control points.

- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a [land surveyor] [professional engineer] to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by [land surveyor] [professional engineer], that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
  - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to [minimize] [prevent] interruption to occupied areas.
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. [Concrete] [and] [Masonry]: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.

- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in [Section 015000 "Temporary Facilities and Controls."] [Section 017419 "Construction Waste Management and Disposal."]
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.9 STARTING AND ADJUSTING
- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
  - B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.



- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

## SECTION 017400 - WARRANTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
  - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
  - 2. Division 1 Section "Contract Closeout" specifies contract closeout procedures.
  - 3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
  - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- D. Separate Prime Contracts: Each prime contractor is responsible for warranties related to its own contract.

#### 1.3 DEFINITIONS

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

#### 1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

#### 1.5 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
  - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.
- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
- C. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
  - 1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- D. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
  - 2. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

END OF SECTION 017400

## SECTION 017700 – CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operation and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
    - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Advise the Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
  - 6. Deliver tools, spare parts, extra stock, and similar items.
  - 7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
  - 8. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
  - 9. Complete final cleanup requirements, including touchup painting.
  - 10. Touch up and otherwise repair and restore marred, exposed finishes.

- B. Inspection Procedures: On receipt of a request for inspection from the Contractor, accompanied by the Contractor's punchlist, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. When the Architect confirms the Contractor's compliance with the requirements for substantial completion he will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected, or requirements that must be fulfilled, before the certificate will be issued.
1. The Architect will repeat inspection when requested and assured that the Work is substantially complete.
  2. Results of the completed inspection will form the basis of requirements for final acceptance.
  3. The Architect and its consultants will only provide two inspections of any given portion of the Work: one initial inspection to verify Substantial Completion, and one subsequent inspection to confirm that punchlist items have been corrected. The costs of all additional visits will be charged to the Contractor by the Owner.

#### 1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
  2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
  4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
  5. Submit consent of surety to final payment.
  6. Submit a final liquidated damages settlement statement.
  7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

#### 1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.



- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
  2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
  3. Note related change-order numbers where applicable.
  4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
  2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
  3. Note related record drawing information and Product Data.
  4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
  2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
  3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
  2. Spare parts list.
  3. Copies of warranties.
  4. Wiring diagrams.
  5. Recommended "turn-around" cycles.
  6. Inspection procedures.
  7. Shop Drawings and Product Data.
  8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals.
  2. Record documents.
  3. Spare parts and materials.
  4. Tools.
  5. Lubricants.
  6. Fuels.
  7. Identification systems.
  8. Control sequences.
  9. Hazards.
  10. Cleaning.
  11. Warranties and bonds.
  12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Startup.
  2. Shutdown.
  3. Emergency operations.
  4. Noise and vibration adjustments.
  5. Safety procedures.
  6. Economy and efficiency adjustments.
  7. Effective energy utilization.

### 3.2 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1 Section "Construction Facilities and Temporary Controls."
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
    - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

- e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
  - 1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Architect or by email to Architect. Enable reviewer comments on draft submittals.

- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents. Indicate volume number for multiple-volume sets.

#### 1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.



6. Name and contact information for Construction Manager.
  7. Name and contact information for Architect.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."
- 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL
- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
  3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 1.8 EMERGENCY MANUALS
- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.

5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.
- 1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS
- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.
- 1.11 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823



## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for coordinating project record documents covering the Work of multiple contracts.
  - 2. Section 017300 "Execution" for final property survey.
  - 3. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and one of file prints.
      - 3) Submit record digital data files and one set(s) of plots.
      - 4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit three paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
      - 3) Print each drawing, whether or not changes and additional information were recorded.

- c. Final Submittal:
    - 1) Submit one paper-copy set(s) of marked-up record prints.
    - 2) Submit record digital data files and three set(s) of record digital data file plots.
    - 3) Plot each drawing file, whether or not changes and additional information were recorded.
  - B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
  - C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
    - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
  - D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
  - E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.
- 1.4 RECORD DRAWINGS
- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
    - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      - b. Accurately record information in an acceptable drawing technique.
      - c. Record data as soon as possible after obtaining it.
      - d. Record and check the markup before enclosing concealed installations.
      - e. Cross-reference record prints to corresponding photographic documentation.
    - 2. Content: Types of items requiring marking include, but are not limited to, the following:
      - a. Dimensional changes to Drawings.
      - b. Revisions to details shown on Drawings.
      - c. Depths of foundations.
      - d. Locations and depths of underground utilities.
      - e. Revisions to routing of piping and conduits.
      - f. Revisions to electrical circuitry.
      - g. Actual equipment locations.
      - h. Duct size and routing.
      - i. Locations of concealed internal utilities.
      - j. Changes made by Change Order or Construction Change Directive.
      - k. Changes made following Architect's written orders.
      - l. Details not on the original Contract Drawings.

- m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
  1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
  2. Format: DWG
  3. Format: Annotated PDF electronic file.
  4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  5. Refer instances of uncertainty to Architect through Construction Manager for resolution.
  6. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    - a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
    - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect and Construction Manager.
    - e. Name of Contractor.

## 1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file of marked-up paper copy of Specifications.

#### 1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- C. Format: Submit record Product Data as annotated PDF electronic file.
1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

#### 1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

#### 1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's[ and Construction Manager's] reference during normal working hours.

END OF SECTION 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
  - 2. Demonstration and training video recordings.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Date of video recording.
  - 2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
  - 3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.



4. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

#### 1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

#### 1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

#### 1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.

- b. Performance and design criteria if Contractor is delegated design responsibility.
  - c. Operating standards.
  - d. Regulatory requirements.
  - e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
2. Documentation: Review the following items in detail:
  - a. Emergency manuals.
  - b. Systems and equipment operation manuals.
  - c. Systems and equipment maintenance manuals.
  - d. Product maintenance manuals.
  - e. Project Record Documents.
  - f. Identification systems.
  - g. Warranties and bonds.
  - h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.

7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
  
8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## 1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

## 1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  2. Owner will furnish an instructor to describe Owner's operational philosophy.
  3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

- F. Cleanup: Collect used and leftover educational materials and remove from Project site or give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### 1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
  - 1. Submit video recordings on CD-ROM or thumb drive.
  - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
  - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
  - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  - 1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
  - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.

- B. Related Requirements:

- 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
- 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
- 3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
- 4. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

- C. Samples for Verification: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

#### 1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

- 1. Build mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.
- b. Each texture finish indicated.



2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
  1. Manufacturers:
    - a. United States Gypsum Company.
    - b. Georgia-Pacific Corporation.
    - c. Or equivalent.

## 2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
  - 1. Thickness: **1/2 inch (12.7 mm)** and 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  - 1. Thickness: 1/2 inch (12.7 mm) and **5/8 inch (15.9 mm)**.
  - 2. Long Edges: Tapered.
- C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
  - 1. Thickness: **1/4 inch (6.4 mm)**.
  - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
  - 1. Thickness: **1/2 inch (12.7 mm)**.
  - 2. Long Edges: Tapered.
- E. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
  - 1. Core: **5/8 inch (15.9 mm)**, Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- F. Skim-Coated Gypsum Board: ASTM C 1396/C 1396M. Manufactured with a factory-applied skim coat.
  - 1. Core: As indicated **5/8 inch (15.9 mm)**, Type X.
  - 2. Long Edges: Tapered.

## 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. L-Bead: L-shaped; exposed long flange receives joint compound.
    - d. Expansion (control) joint.
    - e. Trim reveal; Reference Product: Gordon 300 Series wall reveal.

## 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use all-purpose compound.
  - 4. Finish Coat: For third coat, use all-purpose compound.
  - 5. Skim Coat: For final coat of Level 5 finish, where indicated, use all-purpose compound.

## 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from **0.033 to 0.112 inch (0.84 to 2.84 mm)** thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch (1.5 mm)** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft. (0.7 sq. m)** in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch- (6.4- to 9.5-mm-)** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide **1/4- to 1/2-inch- (6.4- to 12.7-mm-)** wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

- a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, **16 inches (400 mm)** minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus **12-inch- (300-mm-)** long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws **16 inches (400 mm)** o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced **12 inches (300 mm)** o.c.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners.
  2. LC-Bead: Use at exposed panel edges.
  3. L-Bead: Use where indicated.
  4. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  - 3. Level 5: Where indicated on Drawings.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

### 3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900



## SECTION 093013 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Porcelain tile.
2. Glazed wall tile.
3. Waterproof membrane for thinset applications.
4. Metal edge strips.

- B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for [cementitious backer units] [glass-mat, water-resistant backer board].

#### 1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
  1. Full-size units of each type and composition of tile and for each color and finish required.
  2. Full-size units of each type of trim and accessory for each color and finish required.
  3. Metal edge strips in 6-inch (150-mm) lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
  - 2. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of each type of floor tile installation.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions. Verify condition and moisture content of concrete subfloor prior to installation of flooring and correct any issues prior to installation of flooring.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Waterproof membrane.
  - 2. Metal edge strips.

### 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

### 2.3 TILE PRODUCTS

- A. Ceramic Tile Type TL01: Porcelain floor tile.
  - 1. Certification: Tile certified by the Porcelain Tile Certification Agency.
  - 2. Face Size: 8 by 24 inches (200 by 600 mm).
  - 3. Face Size Variation: Rectified.
  - 4. Thickness: 3/8 inch (10 mm).
  - 5. Face: As indicated.
  - 6. Dynamic Coefficient of Friction: Not less than 0.42.
  - 7. Tile Color, Glaze, and Pattern: Matte finish.
    - a. Basis of Design: Atlas Concorde Solution - Legend or equivalent, Color as scheduled.
  - 8. Grout Color: Mapei 04 'Bahama Beige', as scheduled.

9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
  - a. Base: Surface bullnose, module size 8 by 24 inches.
  - b. Schluter Systems: Jolly aluminum trim on exposed top edges of base or equivalent.
  - c. Internal Corners: Field-buttet square corners.

#### 2.4 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; **0.008-inch (0.2-mm)** nominal thickness. Reference Product: Schluter Kerdi membrane or equivalent.

#### 2.5 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

#### 2.6 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3[, with a VOC content of 65 g/L or less].
  1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to **140 and 212 deg F (60 and 100 deg C)**, respectively, and certified by manufacturer for intended use.

#### 2.7 MISCELLANEOUS MATERIALS

- A. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, **4.0 mils (0.1 mm)** thick.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; aluminum exposed-edge material.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

## 2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped **1/4 inch per foot (1:50)** toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors consisting of tiles **8 by 8 inches (200 by 200 mm)** or larger.
    - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Porcelain Tile: **1/16 inch (1.6 mm)**.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- H. Metal Edge Strips: Install at locations indicated.
- I. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### 3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.



### 3.5 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.
- C. Samples for Initial Selection: For components with factory-applied finishes.
- D. Delegated-Design Submittal: For seismic restraints for ceiling systems.
  - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Ceiling suspension-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
  - 5. Size and location of initial access modules for acoustical panels.
  - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    - a. Lighting fixtures.
    - b. Diffusers.
    - c. Grilles.
    - d. Speakers.
    - e. Sprinklers.
    - f. Access panels.

7. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
  - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

#### 1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockup of typical ceiling area as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide ceiling system by Armstrong World Industries, or comparable product by one of the following or equivalent:
  1. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 for Seismic Category B.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame-Spread Index: Class A according to ASTM E 1264.
  2. Smoke-Developed Index: 50 or less.

### 2.3 ACOUSTICAL PANELS

- A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- B. Classification: Provide panels as follows:
  1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
  2. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 2. Binder shall not contain urea formaldehyde.
  3. Pattern: E (lightly textured).
- C. Color: as indicated on schedule.
- D. Light Reflectance (LR): Not less than LR indicated in a schedule.
- E. Ceiling Attenuation Class (CAC): Not less than CAC indicated in a schedule.
- F. Noise Reduction Coefficient (NRC): Not less than NRC indicated in a schedule.

- G. Edge/Joint Detail: As indicated by manufacturer's designation.
- H. Thickness: As indicated in a schedule.
- I. Modular Size: As indicated in a schedule.
- J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

#### 2.4 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated. Use shadowline edge molding where indicated.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, **G30 (Z90)** coating designation; with prefinished **15/16-inch- (24-mm-)** wide metal caps on flanges.
  - 1. Structural Classification: Heavy-duty system.
  - 2. End Condition of Cross Runners: Butt-edge type.
  - 3. Face Design: Flat, flush.
  - 4. Cap Material: Cold-rolled steel.
  - 5. Cap Finish: Painted white unless otherwise noted.

#### 2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than **0.135-inch- (3.5-mm-)** diameter wire.
- C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
  - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 7. Do not attach hangers to steel deck tabs.
  - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 9. Space hangers not more than **48 inches (1200 mm)** o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than **8 inches (200 mm)** from ends of each member.
  - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Screw attach moldings to substrate at intervals not more than **16 inches (400 mm)** o.c. and not more than **3 inches (75 mm)** from ends. Miter corners accurately and connect securely.
  - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.



- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  - 3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

### 3.3 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of **1/8 inch in 12 feet (3 mm in 3.6 m)**, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of **1/8 inch in 12 feet (3 mm in 3.6 m)**, non-cumulative.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
  - 1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for **200 lbf (890 N)** of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for **440 lbf (1957 N)** of tension.
  - 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- C. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

### 3.6 ACOUSTICAL CEILING PANEL SCHEDULE

#### A. Acoustical Panels.

1. Type XII: Mineral base with painted face overlay.
  2. Type: Form 2, water felted.
  3. Pattern: E (lightly textured).
  4. LR: Not less than 0.90.
  5. CAC: 35.
  6. NRC: 0.70.
  7. Thickness: 3/4 inch (18 mm).
  8. Modular Size: 24 by 24 inches (610 by 610 mm)
- Reference Products:  
ArmstrongWorld Industries –

Type AC-4 - Health Zone Optima square lay-in 3114, 24 x 24 with 15/16" grid. Texture: Fine, Humigard Plus, BioBlock+.

#### B. Suspension Systems for Acoustical Panel Ceilings: Where this designation is indicated, provide acoustical panel ceiling suspension system complying with the following:

1. Products: Provide one of the following or approved equal:
  - a. Prelude exposed tee system
2. Wide-Face, Single-Web, Steel Suspension System at all 2' x 4' (APC-B) locations as shown on the ceiling plans: Main and cross runners roll formed from cold-rolled steel sheet electrolytically zinc coated, with prefinished **15/16-inch- (24-mm-)** wide flanges; other characteristics as follows:
  - a. Structural Classification: Heavy-duty system.
  - b. Face Finish: Painted white, unless otherwise noted
  - c. Basis of Design: Armstrong Prelude ML exposed tee.

END OF SECTION 095113

## SECTION 09900 - PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces.
  - 2. Exposed interior items and surfaces.
  - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
  - 4. Paint exposed surface Heavy Duty Floor Coating, where indicated.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
  - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

#### 1.3 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
  - 1. Submit manufacturer's literature including descriptive and performance data.
  - 2. Submit application instructions and methods, including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness.
  - 3. Submit material safety data sheets (MSDS) for each product.
  - 4. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated, if not indicated on Color Schedule.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.
  
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.6 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
  - 1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products by Sherwin-Williams are the basis of design and set the standard of quality required or equivalent.
- B. Substitutions: Equivalent products of other manufacturers may be submitted for approval providing the products submitted are of the same types, have label analyses similar to those specified, meet or exceed the performance criteria, and are suitable for the use intended.
- C. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

- C. Colors: Match colors indicated by reference to manufacturer's color designations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
    - c. When transparent finish is required, backprime with spar varnish.
    - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
  - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
  - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
  - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
  1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  3. Provide finish coats that are compatible with primers used.
  4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer on metal surfaces that have been shop primed and touchup painted.



3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- 3.4 CLEANING
- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.6 INTERIOR PAINT SCHEDULE

- A. Drywall and Plaster:
  - 1. Low Luster / Satin Finish – Acrylic.
    - a. Primer: Preprite 200 Primer.
    - b. 2nd & 3rd coat: Promar 200 Eggshell-walls, Flat-ceilings.
  - 2. Acrylic Epoxy.
    - a. Primer: ProMar 200 latex primer.
    - b. 1st & 2nd coat: Pro-Industrial Pre-Catalyred Acrylic Epoxy.
- B. Wood:
  - 1. Semigloss Finish – Acrylic.
    - a. Primer: Preprite Classic Primer.
    - b. 2nd & 3rd coat: Promar 200 Semi-gloss.
  - 2. Semi-Transparent Satin (waterborne) with Urethane Finish, new and refinished (Alternate) wood.
    - a. 1st coat: Wood Classics Stain.
    - b. 2nd & 3rd coat: Wood Classics Polyurethane Varnish.
  - 3. Clear Finish – Waterborne Urethane, new and refinished (Alternate) wood.
    - a. Two (2) coats: Wood Classics Polyurethane Varnish.
- C. Ferrous Metal:
  - 1. Semigloss Finish – Rust Inhibitive Acrylic Primer with Acrylic Finish.
    - a. Primer: ProCryl Universal Primer.
    - b. 2nd & 3rd coat: ProClassic Waterborne, Semi-gloss.
  - 2. Gloss Finish – Rust Inhibitive Acrylic Primer with Acrylic Finish.
    - a. Primer: ProCryl Universal Primer.
    - b. 1st & 2nd coat: ProClassic Waterborne, Gloss.

END OF SECTION 099100

## SECTION 102600 - WALL AND DOOR PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Abuse-resistant wall coverings.

- B. Related Requirements:

- 1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- 2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

- B. Shop Drawings: For each type of wall and door protection showing locations and extent.

- 1. Include plans, elevations, sections, and attachment details.

- C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

- 1. Abuse-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of handrail.

- B. Material Certificates: For each type of exposed plastic material.

- C. Sample Warranty: For special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
  - 2. Keep plastic materials out of direct sunlight.
  - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.

## 2.3 ABUSE-RESISTANT WALL COVERINGS

A. Abuse-Resistant Sheet Wall Covering PWC11: Fabricated from Fiber-Reinforced Plastic Panel material.

1. Basis of Design: PCW11 FRP panels by Panolam or equivalent.
  - a. Sheet Thickness: **0.09 inch**.
  - b. Color and Texture: White with smooth finish, as scheduled.
  - c. Height: Full height to ceiling, as scheduled.
2. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
3. Mounting: Adhesive.

## 2.4 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.5 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.3 INSTALLATION

- A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
  1. Provide anchoring devices and suitable locations to withstand imposed loads.
  2. Where splices occur in horizontal runs of more than **20 feet (6.1 m)**, splice aluminum retainers and plastic covers at different locations along the run, but no closer than **12 inches (305 mm)** apart.
  3. Adjust end caps as required to ensure tight seams.
- D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

### 3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600



## SECTION 200000 - COMMON MECHANICAL/ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Where Paragraphs of this Section conflict with similar paragraphs of Division 01, the more stringent specification requirements shall prevail.
- C. This section shall apply to the following Divisions:
  - 1. Division 21 - Fire Suppression
  - 2. Division 22 - Plumbing
  - 3. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)
  - 4. Division 26 - Electrical
  - 5. Division 27 - Communications
  - 6. Division 28 - Electronic Safety and Security

#### 1.2 SUMMARY

- A. Perform work and provide material and equipment as shown on the drawings, as specified and in accordance with this Section. Completely coordinate work of this Division with work of others and provide a complete and fully functional installation.
- B. Drawings and Specifications form complimentary requirements. Provide work specified and not shown; work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation
- C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from authorities that have jurisdiction. Perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.
- D. These documents are not intended to be complete construction documents. They are issued for the purpose of obtaining a guaranteed maximum price (GMP) and are not suitable for takeoff bidding. These documents do, however, describe the systems required and approximately where the larger equipment is to be located. Include allowances in estimates to fully complete the system including all interconnecting and coordination and installation details and components and extending the system into and throughout all spaces. Include allowances for start up and for making the systems fully operational, and for scope and design contingencies. Future changes in price above the GMP, for items not shown on these GMP drawings shall not be allowed if the system itself is shown or described in these documents. The only future changes in price that shall be allowed are if new systems are added.
- E. Examine Drawings and other Sections of Specifications for requirements that affect work of this Section.
- F. Attention is directed to the following specialized requirements of this Section:
  - 1. **RECORD DRAWINGS.** A requirement to incorporate photographs, taken during construction, of buried and concealed components is incorporated.
  - 2. **SUBMITTALS.** A special cover sheet for each shop drawing, to be filled out by the contractor, is required. A description of "Acceptable Manufacturers" is included. No other manufacturers shall be considered for this project. The turn-around time Vanderweil requires to process shop drawings is described.
  - 3. **Paragraph COMMISSIONING OF EQUIPMENT AND SYSTEMS.** Requirements for commissioning of systems and equipment shall apply to **GENERAL COMMISSIONING REQUIREMENTS** within Division 01.

### 1.3 DEFINITIONS

- A. As used in all Sections, "provide" means "furnish and install." "Furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support," and "Install" means "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project. "Architect" means the "Prime Design Consultant." If R.G. Vanderweil Engineers, LLP is not the prime design consultant, the Architect may authorize R.G. Vanderweil Engineers, LLP to act on the Architect's behalf in matters concerning the all Sections of specifications.
- B. "RFI" means "Contractor's Request for Information."
- C. Insofar as submittals, reviews, and approvals are concerned, the words "Architect" and "Engineer" may be used interchangeably in the mechanical and electrical divisions.

### 1.4 CONTRACT DOCUMENTS

- A. Listing of Drawings does not limit responsibility of determining full extent of work required by these Contract Documents. Refer to Architectural, Fire Protection, Plumbing, HVAC, Electrical, Communication, Electronic Safety and Security, Structural, Site Utility and all other Drawings and other Sections that indicate types of construction in which work shall be installed and work of other trades with which work of this Section must be coordinated
- B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of an item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
- D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials necessary to make the systems fully complete, fully coordinated with other systems and between different trades, and the structure and space available, and operational.
- E. Information and components shown on riser diagrams, but not shown on plans, and vice versa, shall apply or be provided as if expressly required on both.
- F. Data that may be furnished electronically (on compact disk (CD), electronic mail, or otherwise) is diagrammatic. Electronically furnished information is subject to the same limitation of precision described above. If furnished, electronic data is for convenience and generalized reference, and shall not substitute for sealed or stamped construction documents.

### 1.5 ELECTRONIC CAD FILES

- A. Electronic CAD files for Fire Protection, Plumbing, HVAC, Electrical, Communication, or Electronic Safety and Security drawings shall be furnished by Engineer at contractor's request. These files shall be provided on Engineer's FTP site in the software release used by the Engineer. If other media or software version is requested, Engineer shall require advance reimbursement of processing costs.
- B. Requests should be made by filling out the following form letter and providing an authorized signature. The requested information shall not be released prior to receipt of this letter for the appropriate documents.

DATE

NAME

ADDRESS

Re: JOB# JOB NAME

Dear NAME:

Per the request of **[Owner/Client]**, we are pleased to offer you the following electronic files:

[ELECTRONIC FILE **Names, date of file, description**].

Vanderweil Engineers agrees to provide the above-referenced electronic files to **[Addressee]**. **[Addressee]** recognizes that data recorded on or transmitted as electronic files are subject to undetectable alteration, either intentional or unintentional, due to among other causes, transmission, conversion, media degradation, software error, or human alteration. Accordingly, the electronic files are provided to **[Addressee]** for informational purposes only and not as an end product or Contract Document.

Vanderweil Engineers makes no warranties, either express or implied, regarding the fitness or suitability of the electronic files. The electronic files are instruments of professional service, and shall not be used, in whole or in part, for any project other than that for which they were created, without the express written consent of Vanderweil Engineers.

Accordingly, **[Addressee]** agrees to waive any and all claims against Vanderweil Engineers and **[Owner/Client]** resulting in any way from the use, unauthorized reuse or alteration, or misuse of the electronic files, and to defend, indemnify and hold Vanderweil Engineers and **[Owner/Client]** harmless from any claims, losses, damages, or costs, including attorneys fees, arising out of the use, reuse, alteration, or misuse of the electronic files.

Further:

1. Vanderweil Engineers grants Owner/Client a limited license to reproduce such data for this Project only.
2. Owner/Client agrees not to sell, assign or lease any rights in the designs, models, drawings, information and depicted works in any form to any person or entity.
3. Owner/Client further agrees not to remove any copyright notices, labels or marks on the designs, drawings, information and depicted works.
4. Owner/Client agrees not to make any modifications to the Electronic Files. Furthermore, the Owner/Client agrees not to add sections or cut model data or add views without Vanderweil Engineers consent and written direction/approval.
5. Owner/Client agrees that any electronic/model data provided in the Electronic Files is for Owner/Client's and their contractor and subcontractors reference only and does not alleviate Owner/Client's and their contractor and subcontractors from the responsibility for material take offs and cost estimations.
6. BIM (i.e. Revit/Navisworks) models and associated files shall only contain elements and content that Vanderweil Engineers deems necessary and appropriate to share. No specific Level of Detail (LOD) is implied or expected. The Recipient agrees that no Revit families or Revit content shall be removed from the model and/or used for any other purpose than supporting this specific project.
7. BIM (i.e. Revit/Navisworks) models are not fabrication models and are provided to support the design intent only.
8. Under no circumstances shall the transfer of ownership of electronic data, or hard copy thereof, be deemed to be a sale by the Vanderweil Engineers of tangible goods, and Vanderweil Engineers makes no warranties, express or implied, of merchantability or of fitness for a particular purpose.
9. The Electronic Files issued are current as of the date of issue indicated on the files. Vanderweil Engineers is not responsible or liable for providing any updates or modifications that may or may not have occurred since the issue date shown on the files. The Electronic Files may also represent only a portion - not a complete set - of the construction documents or model data and, as such, they may be incomplete or inconsistent with the most recent design. Vanderweil Engineers makes no representation as to its completeness, currency or accuracy and Vanderweil Engineers shall not be responsible to advise Owner/Client of any changes which may hereafter be made to the Project plan or configuration or other information contained in the Electronic Files.
10. Owner/Client acknowledges that the designs, drawings, information and depicted works are protected by copyright laws, and that Vanderweil Engineers, or its Consultants, as appropriate, is the author and/or owner of same.
11. Vanderweil Engineers, or its Consultants, as appropriate, retains all copyrights to the designs, drawings, information and depicted works on the disk and grants to Owner/Client a limited license to reproduce such information in connection with Owner/Client or their contractors or subcontractor's work on the Project, and no other.

12. The use of such information shall be at Owner/Client and their contractors or subcontractor's sole risk and without any liability, risk or legal exposure to the Vanderweil Engineer, or its Consultants. These Electronic Files are supplied as a convenience to the Owner/Client and are provided in an editable format. Due to the potential that the information set forth in the Electronic Files can be modified by the Owner/Client and their contractors or subcontractors or others, unintentionally or otherwise, the Owner/Client agrees to waive and release all claims or potential claims against Vanderweil Engineers and its Consultants, and their respective officers, directors, members, employees and agents relating to, or arising out of, the use of the Electronic Files, by reason of any act or omission of such parties, under any legal theories whatsoever, specifically including the negligence of any released party.
13. Owner/Client understands that any transfer or translation of computer data from one computer system or environment to another can result in loss of important data and Owner/Client assumes that risk.
14. Owner/Client agrees to check with Vanderweil Engineers periodically for the most current version and/or any updates to the Electronic Files.

This License Agreement terminates at the date of substantial completion of the Project or the termination of the construction contract whichever comes first.

Please acknowledge your acceptance of these terms and conditions by returning a signed original of this letter.

Very truly yours,

**R.G. Vanderweil Engineers, LLP**

AUTHOR'S NAME

AUTHOR'S TITLE

INITIALS/SIGNOFF/WP INITIALS

Accepted and Agreed:

Authorized signature: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

#### 1.6 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in writing before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, provide material, installation or work that is of the higher standard.
- D. It is the requirement of these contract documents to require provision of systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements. In these cases, where notification required by Paragraph (A) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed in accordance with the design intent.
- E. In cases covered by Paragraph (D) above, where the contractor believes engineering guidance is needed, submit a sketch identifying proposed solution. Architect shall review, note if necessary, and approve the sketch.
- F. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns equipment such as disconnects, starters, etc., the discrepancy shall be brought to the Architect's attention in accordance with paragraph (A) above. If the scope is not resolved prior to the Award of Contract, the Electrical Contractor shall provide such items.

#### 1.7 MODIFICATIONS IN LAYOUT

- A. Drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet ceiling heights and other Architectural requirements.
- B. In order to obtain the intended aesthetics in spaces used by building occupants, prior to installation of visible material and equipment (including access panels), review Architectural Drawings for desired locations and where not definitively indicated, request information from Architect.
- C. Check Contract Drawings, as well as Shop Drawings, to verify and coordinate spaces in which work of this section shall be installed.
- D. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to paragraphs above. Systems shall be run in a rectilinear fashion.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

#### 1.8 REQUEST FOR INFORMATION (RFI'S)

- A. Where an RFI is a request to resolve a conflict or an un-clarity, or a request for additional detail, contractor's RFI shall include a sketch or equivalent description of contractor's proposed solution, in accordance with Paragraphs titled "Discrepancies in Documents"; and "Modifications in Layout" above.

- B. To expedite the processing of RFIs, the Contractor shall submit the attached form, or similar form including the same information to the Architect, with a copy to the Engineer. Contractor shall include proposed solution, with sketches as required, in the indicated space on the form.
- C. The form and all RFI related documents shall be submitted as one PDF (non-binder) format file, without password protection. If it is impossible to convert some information to PDF, it may be submitted as a second file, not password protected.

**RFI FORM**

FAX RFI

RFI No. _____
Date Submitted: _____ Contractor: _____
Date Required: _____
Job Name: _____ Person: _____
Spec. Sec.: _____ Contr. Fax No.: _____
Vanderweil Fax No.: (617) 423-7401 Arch. Fax No.: _____

Contractor Field Question (Provide narrative and/or sketch):
Contractor Proposed Solution (Provide narrative and/or sketch):
Vanderweil Response:



#### 1.9 RELATED WORK IN OTHER SECTIONS

A. The following work is not included and shall be performed under other Sections.

1. Excavation and backfill.
2. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal decks.
3. Flashing of wall and roof penetrations.
4. Installation of access panels in floors, walls, furred spaces or above ceilings.
5. Painting, except as specified herein.
6. Structural supports necessary to distribute loading from equipment to roof or floor except as specified herein or indicated on drawings.
7. Temporary light, power, water, heat, gas and sanitary facilities for use during construction and testing.
8. Electric power wiring for all equipment shall be provided by Division 26, Electrical.
9. Installation of circuit breakers (furnished by ATC Contractor) and final electrical panel terminal connections for ATC control power wiring shall be provided by Division 26, Electrical.
10. Wall and ceiling enclosures and shafts for supply, return and exhaust ductwork as shown on drawings.

#### 1.10 SITE VISIT

A. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment shall be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by an experienced observer.

#### 1.11 EXISTING CONDITIONS AND PREPARATORY WORK

- A. Before starting work in a particular area of the project, visit the location and examine conditions under which work must be performed including preparatory work done under other Sections or other Contracts or by the Owner. Review geometrical constraints, such as ceiling heights, to ensure constructability and access for maintenance. Report conditions that might adversely affect work in writing to the Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing conditions and preparatory work.
- B. Existing Concrete Slabs. Before coring or other penetration of existing slabs, scan the area where the work is to be performed in order to locate existing in-slab or below-slab utilities, and position the slab penetrations so as to avoid these.

#### 1.12 CODES, STANDARDS, AUTHORITIES AND PERMITS

- A. Perform work in accordance with rules, regulations, standards, codes, ordinances, and laws of local, state, and Federal governments, and other authorities that have legal jurisdiction over the site.
- B. Prior to work commencement of work, notify State and applicable authorities and submit all of the applicable notifications for construction, operation and/or demolition.
- C. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:
1. Local and state building, plumbing, mechanical, electrical, fire and health department codes.
  2. American Gas Association (AGA).
  3. National Fire Protection Association (NFPA).
  4. American Insurance Association (AIA) (formerly National Board of Fire Underwriters).
  5. Occupational Safety and Health Act (OSHA).
  6. Underwriters Laboratories (UL)
  7. Factory Mutual Association (FM)

8. Owner's Insurance Underwriter.
  - D. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME, ANSI, ASTM, and AGA for intended service.
  - E. When requirements cited in this Specification conflict with each other or with Contract Documents, most stringent shall govern work. Architect may relax this requirement when relaxation does not violate ruling of authorities that have jurisdiction. Approval for relaxation shall be obtained in writing.
  - F. Unless indicated otherwise, the most recent editions of applicable specifications and publications of the following organizations form part of these Contract Documents.
    1. American National Standards Institute (ANSI).
    2. American Society of Mechanical Engineers (ASME).
    3. National Electric Manufacturers Association (NEMA).
    4. American Society for Testing and Materials (ASTM).
    5. American Water Works Association (AWWA).
    6. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
    7. Air Moving and Conditioning Association (AMCA).
    8. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
    9. Air Conditioning and Refrigeration Institute (ARI).
    10. Thermal Insulation Manufacturers Association (TIMA).
    11. Institute of Electrical and Electronics Engineers (IEEE).
    12. Insulated Cable Engineers Association (ICEA).
    13. Manufacturer's Standardization Society of the Valve & Fittings Industry (MSS)
  - G. Specific reference is made to the following NFPA standards which contain an exceptionally high quantity of mechanical, electrical, and fire protection requirements. These standards as referenced by the State Building Code shall apply in full.
    1. No. 13 - Installation of Sprinkler Systems
    2. No. 14 - Installation of Standpipe and Hose Systems
    3. No. 20 - Installation of Centrifugal Fire Pumps
    4. No. 30 - Combustible Liquids
    5. No. 37 - Installation of Use of Stationary Combustion Engines and Gas Turbines
    6. No. 45 - Fire Protection for Laboratories Using Chemicals
    7. No. 70 - National Electric Code
    8. No. 72 - National Fire Alarm Code
    9. No. 101 - Life Safety Code
  - H. Secure and pay for all permits and inspections required by the Authorities having Jurisdiction. Secure trade permits prior to beginning work.
- 1.13 COORDINATION DRAWINGS
- A. A single set of coordination drawings shall be mutually prepared by all mechanical and electrical trades.
  - B. The initiation of these drawings begins with the Sheet Metal Subcontractor.
  - C. The Sheet Metal Subcontractor shall prepare a complete set of electronic type background drawings in approved versions of REVIT, Navisworks, or approved alternative at scale not less than 3/8 inches equals 1 foot-0 inches showing structure and other information as needed for coordination. Sheet metal layout including horizontal and vertical offsets and changes in direction and necessary access panels shall be shown thereon, as well as all fire walls and smoke partitions, which shall be shown in a different color than the regular partitions and the sheet metal. All trades shall electronically add their systems to the electronic formatted drawings, each trade in a different color. These electronic files shall be considered the project Coordination Drawings. Drawing layers must coincide with original Vanderweil electronic format.

- D. Each of the mechanical, electrical and other specialty trades shall add its work to these background drawings with appropriate offsets, elevations and grid dimensions, and showing necessary access panels. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur (e.g. corridors). This may apply to entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
- E. Each specialty trade shall sign and date each plotted coordination drawing. Return drawings to the Sheet Metal Subcontractor, who shall route them sequentially to all specialty trades.
- F. Where conflicts occur with placement of materials of various trades, the Sheet Metal Subcontractor shall be responsible to coordinate the available space to accommodate all trades. Resulting adjustments shall be initialed and dated by the specialty trade. The Sheet Metal Subcontractor shall then final date and sign each drawing. If conflict cannot be resolved, the decision of the General Contractor/Construction Manager shall be final.
- G. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of installation conflicts affecting his work and of schedule ramifications.
- H. Sheet Metal Subcontractor shall make copies of all coordination drawings for submission. Fabrication shall not start until copies of completed coordination drawings are received by the Architect and have been reviewed.
- I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Construction Manager or General Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.
- J. After Review:
  - 1. After review of coordination drawings, the method used to resolve interferences not previously identified shall be as described in Paragraph titled "Modifications in Layout" above.
  - 2. All changes to reviewed coordination drawings shall be in writing by the Architect prior to start of work in affected area.
- K. Distribution of Reviewed Coordination Drawings:
  - 1. The Sheet Metal Subcontractor shall provide one color coded electronic copy and one color coded hard copy of the reviewed Coordination Drawings to each of the specialty trades, the Contractor and the Owner.
- L. The main paths of egress and for equipment removal, from main mechanical and electrical rooms shall be clearly shown on the coordination drawings.
- M. Coordination Drawings shall include, but are not limited to:
  - 1. Plumbing systems, piping and equipment.
  - 2. HVAC piping, systems and equipment.
  - 3. Control systems.
  - 4. Electrical distribution, systems and equipment.
  - 5. Lighting systems and fixtures.
  - 6. Sheet metal work, components and accessories (e.g. coils, terminal boxes).
  - 7. Fire protection and sprinkler system, piping and heads.
  - 8. Structural.
  - 9. Electrical Equipment Room layouts.
  - 10. Environmental Rooms and associated refrigeration/heating systems.
  - 11. Partition/room layout.
  - 12. Ceiling tile and grid
  - 13. Access panels.

14. Smoke and fire dampers.
15. Roof drain piping.
16. Major electrical conduit runs, panel boards, feeder conduit and racks of branch conduit.
17. Above ceiling miscellaneous metal.
18. Heat tracing of piping.

1.14 SUBMITTALS

A. This Paragraph supplements Division 01.

B. Definitions:

1. Submittals including product data and shop drawings are information prepared to illustrate portions of the work in more detail than shown in the Contract Documents.
2. Coordination Drawings are detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed in order to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Plumbing, Architectural, Structural and other work.
3. Electronic Copy means copy in a searchable PDF format, and excludes scanned material and faxed material. Scanned material and faxed material shall not be submitted.

C. Submittal Cover Sheet:

1. Submittals shall be accompanied by the following coversheet with all information completely filled out. Submit a separate cover sheet with shop drawings for each section of the specifications.
2. Where the section specifies a class of products (for example, plumbing fixtures, wiring devices, insulation) the submission for that section shall either be complete, including all products within that class or it shall contain an index listing all products within that class and designating which ones are included with that submittal. Where the submission covers more than one product, the information required on the cover sheet shall be clearly differentiated by product if it does not apply in common for all included products.

---

**SUBMITTAL COVER SHEET**

---

PROJECT: \_\_\_\_\_ DATE: \_\_\_\_\_

DIVISION NO. \_\_\_\_\_ SECTION NO. \_\_\_\_\_ PARA. NO. \_\_\_\_\_

DESCRIPTION: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

CONTRACT DRAWING REFERENCE NO: \_\_\_\_\_

EQUIPMENT TAG (From Dwg. Schedules): \_\_\_\_\_

SUBMISSION (check one):                       First                       Second                       Third                       Fourth

**INFORMATION AND CHECKLIST**

1. Direct contact information for product representative or supplier to which questions can be referred (name, address, phone number, and email address).  
Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone Number: \_\_\_\_\_ Email: \_\_\_\_\_

				Comment
2.	Are all specified or scheduled items included and exactly match scheduled/specified items?	Yes	No	
3.	Is this item a substitution?	Yes	No	
4.	Are deviations clearly identified?	Yes	No	
5.	Does equipment fit space shown on construction documents, coordination drawings, and actual field conditions?	Yes	No	
6.	Does this material/equipment add expense to other trades or project costs?	Yes	No	
7.	Is control interface coordinated?	Yes	No	
8.	List electrical characteristics (Voltage/Phase/Hz/Amps)			_____

D. Submittal Contents and Format

1. Construction Manager or General Contractor shall pre-review submittal packages for compliance with Contract Documents and then submit for review by Architect. Review by Construction Manager or Contractor is intended to ensure that the submittals include the foregoing cover sheet, are in the correct electronic or paper format as specified below, and that the item fits into the space provided. Also, that the submittal contains adequate information to verify specification requirements as well as the performance and dimensional requirements shown on the drawings. If a shop drawing is returned with a submittal status of "REJECTED" or "REVISE AND RESUBMIT", it indicates the shop drawing was not adequately reviewed by the Contractor. Subsequent submittals shall include a written response to previous items.
2. Submittal Contents
  - a. Submittals shall be comprehensive and fully self contained.
  - b. Submittals shall include page numbers to allow reviewer to identify specific location where comment applies.
  - c. Electronic submittals shall be fully self contained and shall not contain links to associated websites. The submittal coversheet, transmittal, and document shall be prepared as one searchable PDF (non-binder) format file, without password protection. If it is not possible to convert some material into PDF, it is acceptable to submit this as a second file.
  - d. Submittals shall include all catalog data and physical and performance characteristics and plans and diagrams as necessary to confirm compliance with plans and specifications.
  - e. Submittals shall contain only information relevant to the particular equipment or materials to be furnished. Clearly indicate the piece of equipment or material being provided. Do not submit generic catalog cuts which describe several different items in addition to those specific items being provided, unless all irrelevant information is marked out or relevant information is clearly differentiated. Those features that are not being proposed for this project shall be crossed out so as not to imply that they are included.
  - f. Where applicable, equipment Product Data shall include wiring and interlock diagrams using the standard wiring diagrams with all terminals, which have been provided for use by the various Subcontractors clearly indicated. For example, remote start/stop wiring from BMS system to a motor control center shall be clearly identified.
3. Division 23 shop drawings and installation layout drawings for heating, pumping, process piping, and refrigeration systems prepared by the Installer shall note name(s), license number(s), and license expiration dates of the installing firm.
4. Submit the following for review, including a submittal cover sheet for each product:
  - a. Electronic copy (see above definition of electronic copy).
  - b. Electronic copy with cover sheet, plus one paper copy by overnight mail, for the following submittals:
    - 1) HVAC equipment
    - 2) Plumbing and fire protection equipment
    - 3) Electrical equipment
    - 4) Electrical switchgear and generator
    - 5) Electrical short circuit, coordination, and arc flash studies
    - 6) Lighting
    - 7) Fire protection calculations
    - 8) Other submittals if larger than 8-1/2x11
  - c. Electronic copy with cover sheet plus one paper copy in 11x17 format with cover sheet, by overnight mail for all controls submittals.

E. Sheet Metal Shop Drawings



1. Provide electronic copy, containing sufficient plans, elevations, sections, details and schematics to describe work clearly. Plans shall be 3/8 inch = 1 foot=0 inches scale and shall indicate work of other Sections where physical clearances are critical and where interferences are possible. Provide larger scale details to show complete installation. Sheet metal drawings shall show elements of Architect's reflected ceiling plan, exposed ductwork, walls, partitions, diffusers, registers, grilles, fire dampers, sleeves and other aspects of construction for coordination.
  2. After review, Contractor to receive electronically transmitted response report for all reviewed submittals which includes the following information:
    - a. Submittal status
    - b. List of reviewer's comments
    - c. Copy of returned submittal. All submittals shall be returned electronically, with the exception of coordination drawings, which shall have one copy returned with comments through overnight mail.
  3. Re-submittals shall be complete and shall include a cover letter summarizing the corrections made in response to the review comments and the submittal page numbers which were revised.
  4. Shop drawings showing manufacturer's product data shall contain detailed dimensional drawings, accurate and complete description of materials of construction, manufacturer's published performance characteristics and capacity ratings (performance data, alone, is not acceptable), electrical requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.
  5. Provide shop drawing submittals showing details of piping connections to ALL equipment. If connection details are not submitted and connections are installed incorrectly in the field, reinstall within the original contract price.
- F. Acceptable Manufacturers: The Architect's mechanical design for each product is based on the single manufacturer listed in the schedule or shown on the drawings. In Part 2 of the specifications certain Alternate Manufacturers may be listed as being acceptable. These are acceptable only if, as a minimum, they:
1. Meet all performance criteria listed in the schedules and outlined in the specification. For example, to be acceptable, an air handling unit must deliver equal CFM against equal external static pressure using equal or less horsepower as the air handler listed in the schedules.
  2. Have identical operating characteristics to those called for in the specification. For example, a reciprocating compressor shall not be acceptable if a rotary model is specified.
  3. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either the space or the product. Clearances to walls, ceilings and other equipment shall be at least equal to those shown on the design drawings. The fact that a manufacturer's name appears as acceptable shall not be taken to mean that the Architect has determined that the manufacturer's products shall fit within the available space - this determination is solely the responsibility of the contractor.
  4. For rooftop mounted equipment and for equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or specifications.
  5. Products must adhere to all architectural considerations including, but not limited to: being of the same color as the product scheduled or specified, fitting within architectural enclosures and details, and for diffusers and plumbing fixtures - being the same size and of the same physical appearance as scheduled or specified products.
- G. Required Use of Acceptable Manufacturers on this Project:
1. Substitution of products other than those of the Acceptable Manufacturers specified herein shall not be made. Only the specified items or the comparable product by one of the specified Alternate

Manufacturers shall be submitted. Products by other manufacturers shall not be used on this project.

H. Deviations

1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the deviation to the attention of the Architect.
2. Without letters flagging the deviation to the Architect, it is possible that the Architect may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Architect has reviewed or approved shop drawings containing the deviation, and shall be strictly enforced.
3. Approval of proposed deviations, if any, shall be made at discretion of Architect.

I. Submittal Status: Electronic and paper submittals shall be returned notated as illustrated below:  
"REVIEWED"

"Reviewed and found generally acceptable. Minor deviations may be noted. No further submittal required if notations are complied with."

"REVIEWED, DEVIATIONS NOTED;  
REVISE AND RESUBMIT"

"Submittal contains deviations which shall be corrected and confirmed by a new submittal."

"REJECTED"

Submittal is incorrect to such an extent that material is unacceptable, or is incomplete to such an extent that a complete review cannot be made. Resubmit in accordance with requirements of the Contract Documents."

"NO ACTION"

Submittal not reviewed.

J. Responsibility

1. Intent of Architect's submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor shop drawing errors or deviations from requirements of Contract Documents. Noting of some errors while overlooking others shall not excuse proceeding in error. Contract Documents requirements are not limited, waived nor superseded by review.
2. INFORM SUBCONTRACTORS, MANUFACTURERS AND SUPPLIERS OF SCOPE AND LIMITED NATURE OF REVIEW PROCESS AND ENFORCE COMPLIANCE WITH CONTRACT DOCUMENTS.

K. Schedule: Incorporate shop drawing review period into construction schedule so that Work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following shop drawing review time requirements into his project schedule. Working days listed reference the time in the Engineer's office. It does not include transmittal or review time of others. Allow at least 10 working days, exclusive of transmittal time, for review each time shop drawing is submitted or resubmitted with the exception that 20 working days, exclusive of transmittal time, are required for the following:

1. HVAC temperature control submittals.

2. HVAC balancing report.
3. Coordination Drawings.
4. Distribution equipment including Panelboards.
5. Short circuit and coordination study
6. Fire protection fabrication drawings.
7. If more than five shop drawings of a single trade are received in one calendar week.

L. List of Proposed Equipment and Materials

1. Within four weeks after Award of Contract and before ordering materials or equipment, submit complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration shall be given to partial lists submitted out of sequence.

1.15 RECORD DRAWINGS

- A. As work progresses and for duration of Contract, maintain complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings. Such changes shall include, but not be limited to, those resulting from RFI's, field conditions, and modifications and additions. Include actual location of existing utilities if they differ from design documents. Record valve tags as they are installed. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, underground (buried) piping routes and supports and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.
- B. Underground and utility work shall be located by distances to landmarks, such as building foundations. Give actual dimensions of everything installed including elevations and elevations at each change in direction.
- C. Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation.
- D. "Record Drawings" are a complete set of drawings containing the information in (A) - (D) above.
- E. The installing Contractor shall certify Record Drawings for accuracy. The Architect/Engineer shall not certify the accuracy of the record drawings - this is the sole responsibility of the Contractor.
- F. The installing contractor shall configure the drawing layers to be the same as those in Vanderweil Engineers' format.
- G. If required by the Authority having jurisdiction, each trade shall submit a set of record drawings for approval by the Authority. Format for submission shall be acceptable to the Authority. Drawing format and size changes, and supplemental information required for the submittal are the responsibility of the installing contractor. Provide copies of submittal to General Contractor, Owner, Architect, and Engineer.
- H. At completion of work, prepare a complete set of record drawings in electronic format. Deliver these to the Architect for approval.
- I. After approval, deliver the following:
  1. Original (not scanned) electronic version of drawings in approved format, notated as "Record Drawings," and conformed to incorporate all changes to the original design noted above. The changes shall be clouded and appropriately identified. Deliver one copy each to the General Contractor, Owner, Architect, and Engineer.
  2. Deliver to the Owner one set of blackline record drawings stamped "record" and signed by the appropriate subcontractors.
  3. Electronic version of contract specifications with addenda incorporated, shall be provided by Vanderweil as the Record Specifications.

1.16 BULLETINS, MANUALS, AND OPERATING INSTRUCTIONS - ELECTRONIC FORMAT

- A. "Electronic Format" means searchable PDF format. It does not include scanned items, which are considered inappropriate.
- B. Obtain at time of purchase of equipment, electronically formatted versions of operation, and lubrication and maintenance manuals for all items. Assemble this literature along with other information in coordinated electronic manuals with additional information describing combined operation of field assembled units, including as-built wiring diagrams. Manual shall contain names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment. Divide manuals into three sections or books as follows:
  - 1. Engineering flow diagrams and controls sequences from project mechanical drawings, approved automatic temperature controls submittal, equipment startup procedures and operational instructions. Startup and operational instructions shall list valves, switches, and other devices used to start, stop and control systems. Describe procedure to be followed in case of malfunctions. Include approved valve directory showing each valve number, location of each valve, and equipment or fixture controlled by valve.
  - 2. Detailed maintenance and troubleshooting manuals containing data furnished by manufacturer for complete maintenance. Include copy of balancing report.
  - 3. Lubrication instructions detailing type of lubricant, amount, and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of first class lubrication program. Include approved summary of lubrication instructions in chart form, where appropriate.
- C. Submit electronic format version of manual(s) to Architect for approval. After approval, submit electronic version and one hard copy for Architect's distribution to Owner. Deliver manuals no less than 30 days prior to acceptance of equipment to permit Owner's personnel to become familiar with equipment and operation prior to acceptance.
- D. Operating instructions: Upon completion of installation, prior to Owner accepting portions of building and equipment for operational use, instruct Owner's operating personnel in operation of systems and equipment. Instruction shall be performed by equipment and controls vendors' factory-trained personnel. Owner shall determine which systems require additional instruction. Duration of instructions for controls shall take equipment through complete cycle of operation (at least five working days). Make adjustments under operating conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 LIFE SAFETY SYSTEMS CERTIFICATION OF COMPLETION

- A. Definitions
  - 1. Life Safety Systems - Mechanical and electrical systems including:
    - a. Fire Suppression Systems
    - b. Fire Notification (Alarm) and Detection Systems
    - c. Egress Signage and Lighting Systems
    - d. Emergency Power Systems
  - 2. Complete - For a system to be complete the following shall be true:
    - a. No further work is required to satisfy the requirements specified in the drawings, specifications and applicable codes and standards.
    - b. Systems are fully operational with power to components, valves open, status indicators in "normal" condition and otherwise ready "as-is" to perform required functions.

- c. Required product data and shop drawing submittals have been submitted and returned with a "Reviewed" status. See Paragraph titled "Submittals" for submittal requirements.
- d. Test certificates have been submitted and returned with a "Reviewed" status. See Paragraph titled "Submittals".
- e. Project visit report observations and "punch list" items have been addressed and/or corrected.
- f. "O&M" documentation and "as-built" plans have been submitted and returned with a "Reviewed" status.

B. Notification of Completion

1. Notify the Architect in writing that the life safety systems are complete at least five (5) working days prior to requesting final certification of completion ("affidavits") from the Architect. The notification shall be in the form of a single formal document endorsed by an individual charged with management responsibility for all trades associated with the life safety systems.
2. Schedule work so life safety systems are complete in advance of other systems. This requirement is to allow the Architect to conduct a final project visit and correction of issues found without affecting issuance of a Certificate of Occupancy by the Authorities Having Jurisdiction.

3.2 SPECIAL RESPONSIBILITIES

A. Cooperate and coordinate with work of other Sections in executing work of this Section.

1. Perform work so that progress of entire project including work of other Sections shall not be interfered with or delayed.
2. Provide information as requested on items furnished under one Section which shall be installed under other Sections.
3. For equipment provided under any division or section which has connection made under the mechanical or electrical sections, obtain detailed installation and hookup information from the equipment manufacturers.
4. Obtain final roughing dimensions or other information as needed for complete installation of items furnished under other Sections or by Owner.
5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under all Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at own expense and to full satisfaction of Architect.
6. Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor-mounted vibrating and rotating equipment provided under this Section.

B. Building Expansion Joints and Firewalls

1. Ductwork, conduit, cable tray, piping, and other horizontal distribution systems shall be provided with approved expansion provisions when passing by building expansion joints. Provide copper ground jumper across expansion joints for electrical components. Systems shall be run through rated walls, partitions, and floors via approved fireproofed sleeves.

C. Installation Shall Provide Access to Systems

1. Installation shall allow clearances for easy access to systems for routine maintenance, for repairs, and for installing new cable in conduit and cable trays.
2. Access panels shall be installed in ceilings that are not composed of removable tiles. These shall be located wherever systems components exist that have moving parts, motors, or other components requiring periodic maintenance, adjustment, or replacement. Access panels shall be shown on Coordination Drawings and shall be of the type and finish as approved by the Architect.

D. Protection of Work

1. Each contractor shall be responsible for work and equipment until finally inspected, tested, and accepted. Carefully store materials and equipment that is not immediately installed after delivery to site. Close open ends of work with temporary covers or plug during construction to prevent entry of obstructing material. Cover work subject to falling debris with temporary covers.
  2. Provide all materials, equipment and labor to provide adequate protection of all equipment during the course of construction. This includes protection from moisture and foreign material. At completion, all work must be turned over to Owner clean and in new condition.
  3. Protect the work and material of other trades that might be damaged by work or workmen and make good all damage thus caused.
- E. Installation Only Items
1. Where it is required to install items that it does not purchase, Contractor shall coordinate the delivery and be responsible for their unloading from delivery vehicles and for safe handling and field storage up to the time of installation.
    - a. Necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.
    - b. Their connection to building systems including the purchase and installation of terminating fittings necessary to adapt and connect them to the building systems.
  2. Carefully examine items upon delivery. Claims that these items have been received in a condition that their installation shall require procedures beyond the reasonable scope of work of this contract shall be considered only if presented in writing within one week of their date of delivery. Unless claims have been submitted, fully recondition or replace damaged items.
- F. Maintenance of equipment and systems: Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions. Protect work and equipment from damage and exposure to moisture and outdoor extreme temperature conditions until finally inspected, tested, and accepted. Carefully store materials and equipment that is not immediately installed after delivery to site. Close open ends of work including piping and ductwork with temporary covers or plugs during construction to prevent entry of obstructing material or debris.
- G. Use of premises shall be restricted as follows:
1. Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Architect.
  2. Store materials in a manner that shall maintain an orderly clean appearance. If stored on-site in open or unprotected areas, equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.
  3. Do not interfere with function of existing sewers and water and gas mains, electrical, or mechanical systems and services. Extreme care shall be observed to prevent debris from entering pipe, ductwork and equipment. Confer with Architect as to disruption of services or other utilities due to testing or connection of new work to existing. Interruption of services shall be performed at time of day or night deemed by Owner to provide minimal interference with normal operation. Obtain Owner's approval of the method proposed for minimizing service interruption.
- H. Surveys and Measurements:
1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct lay out of work.
  2. In event of discrepancy between actual measurements and those indicated, notify Architect in writing and do not proceed with work until written instructions have been issued.



I. Fireproofing:

1. Clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, insofar as possible, prior to start of spray fiber work.
2. Ducts, piping and other items that would interfere with proper application of fireproofing shall be installed after completion of spray fiber work.
3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this Section shall be performed by installer of fireproofing and paid for by trade responsible for damage and shall not constitute grounds for an extra to Owner.

J. Temporary Utilities:

1. Refer to Division 1 regarding requirements.
2. Coordinate work under this Section with progress of construction so that permanent heating system shall be ready to provide temporary heating if permitted by Architect as soon as building is closed in.
3. Provide and direct labor required for attendance, operation and final restoration of permanent heating system if used for temporary heating purposes. Continuous direct attendance shall be provided whenever permanent system is in operation prior to acceptance of permanent heating system by Owner.

K. Airbound Systems

1. If, after plant is in operation, piping systems, coils or other apparatus are stratified or air bound (by vacuum or pressure), they shall be repiped with new approved and necessary fittings, air vents, or vacuum breakers at no extra cost. If connections are concealed in furring, floors, or ceilings, this trade shall bear all expenses of tearing up and refinishing construction and finish, leaving same in as good condition as before it was disturbed.

L. Miscellaneous

1. Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.

3.3 CONTINUITY OF SERVICES

A. Do not interrupt existing services without Owner's approval.

B. Schedule interruptions in advance, according to Owner's instructions. Submit, in writing, with request for interruption, methods proposed to minimize length of interruption.

C. Interruptions shall be scheduled at times of day and work so that they have minimal impact on Owner's operations.

D. Subcontractor shall coordinate shutdowns of existing systems as follows:

1. Give proper notice to Owner when making shutdowns; a minimum of fourteen full days are required.
2. Minimize shutdowns.
3. Provide temporary services where required and perform shutdowns and tie ins at a time convenient to Owner.
4. Subcontractor shall be responsible for completing and filing the Owner's shutdown notice questionnaire.
5. Perform required survey and inspection work required by the notice for shutdown.

E. Include premium time work associated with interruptions of services and/or shutdowns to avoid disruption to Owner's operations.

### 3.4 CLEANING

- A. Cleaning shall be performed prior to commissioning.
- B. Ductwork
  - 1. Ducts shall be thoroughly cleaned so that no dirt or dust shall be discharged from diffusers, registers or grilles, when system is operated.
  - 2. Provide temporary connections required for cleaning. Provide cheesecloth for openings during cleaning.
  - 3. Replace filters prior to final inspection and testing.
- C. Piping
  - 1. Furnish pipe cleaning chemicals, chemical feed equipment, materials and labor necessary to clean piping.
  - 2. Permanently install necessary chemical injection fittings complete with stop valves.
  - 3. After piping systems have been pressure tested and approved for tightness, clean and flush piping as specified and in accordance with applicable codes.
  - 4. Maintain continuous blowdown and make-up during flushing operation.
- D. Equipment
  - 1. After completion of project, clean the exterior surface of equipment, including concrete residue, dirt and paint residue.

### 3.5 PROJECT PUNCH LIST PROCEDURE

- A. When the contract work is substantially complete, each trade contractor shall physically walk down the installation and prepare a punchlist containing an itemization of work remaining for 100 percent completion. The punchlist shall be submitted to the Architect as a prerequisite to the Architect's own punchlist, which shall then be developed to complement that of the trade contractor.
- B. If, when the Engineer arrives at the site certain areas are not complete and ready for punch out, the Engineer shall not review these areas. When a second notification is issued indicating the installation is completed and the Contractor has punched and corrected these areas, the Engineer shall then re-visit the site for final observations and punch list.

### 3.6 FUNDAMENTAL COMMISSIONING OF EQUIPMENT AND SYSTEMS

- A. Refer to commissioning specifications under Divisions 01, 22, 23 and 26 for required assistance to CX Agent for additional submittals, quality assurance, and product requirements. Coordinate startup, checkout and testing procedures with the aforementioned specifications. General contractor and subcontractors are responsible for reviewing, supporting and executing commissioning requirements as defined by this specification.
- B. General
  - 1. Completion of start up and commissioning shall be accomplished as a prerequisite for substantial completion.
  - 2. Operate and maintain systems and equipment until final acceptance by the Owner.
  - 3. All guarantees and warranties shall not begin until final acceptance of the systems and equipment by the Owner. Acceptance requires, at a minimum, completed systems commissioning.
  - 4. The Owner maintains the right to have access to the entire project site to develop his own operational procedures.
  - 5. The following shall be commissioned: HVAC Systems and Equipment, Plumbing Domestic Hot Water System, Electrical Lighting Controls System, and Emergency Generator.
- C. Commissioning Team

1. The commissioning team shall consist of: (a) the Contractor's Commissioning Project Manager ("CxPM"), plus the Project Manager for the controls vendor, plus designated representatives of piping, sheetmetal, electrical, and plumbing subcontractors; (b) the Commissioning Authority ("CxA"), (c) a representative of the Owner.
2. The CxPM shall be assigned by the Construction Manager and shall be an employee of the Construction Manager, or, if there is no Construction Manager, then the CxPM shall be assigned by the General Contractor and shall be an employee of the General Contractor.
3. The CxPM shall serve as the construction team's single point of contact for the CxA. The CxPM shall be responsible for Contractor oversight and direction of the commissioning effort and for communications to all contractors' and subcontractors' representatives on the commissioning team. It shall be the CxPM's responsibility to ensure that all required parties, including technical representatives of equipment vendors, are present at commissioning related effort when required by this specification and/or when requested by the CxA. The CxPM shall witness all commissioning activities and shall initial commissioning forms to indicate satisfactory completion.
4. During the course of construction, in advance of pre-inspection and functional performance testing, the commissioning team shall meet periodically to plan the commissioning effort. Quantity and frequency of meetings shall be determined by the CxA, and shall not exceed a total of four.

### 3.7 PROJECT CLOSE-OUT PROCEDURE

#### A. General

1. The requirements of this section are in addition to and supplement the requirements outlined in Division 01, Execution and Closeout Requirements.
2. Hand-deliver project close-out checklist items and to obtain authorized signed receipt for items requiring Owner sign-off.

#### B. Project Close-Out Checklist

1. Review requirements of each section of the specifications and submit for approval to Architect the sign-off forms that shall become the project close-out checklist. These, at a minimum, shall include the following information shown in attached Project Closeout Checklist Example. The Architect and/or Owner may incorporate additional specific items to the following checklist which shall become part of the project requirements.
2. Close-Out Checklist Example.

PROJECT CLOSE-OUT			
PROJECT:			
DIVISION NO.:			
CONTRACTOR:			
ITEM <sup>1</sup>	DATES		OWNER'S SIGN-OFF
	COMPLETED	RECEIVED BY OWNER	
Permits			
City and County Inspection			
Manufacturer's Warranties			
Contractor's Warranties			
State Fire Rating Data			
Copy of Final Shop Drawings			
List and Possession of Spare Parts			
Pressure Tests			
Equipment Tests Required by Specs			
Manufacturer/Vendor Training of Owner's Personnel Required by Specs			
O & M Manuals			
Record Documents			
Coordination Drawings			
Sanitization Reports			
Commissioning Reports/Letters/Forms			
On Site Training Complete			
Protective Device Settings			
Valve Tags and Charts			
Final ATC Installation Drawings			
Insurance Underwriters Approvals			
Final Punch List (Initialed by contractor that items are complete)			
Building Certificate of Occupancy (CO)			
24 Hour Phone No. for Service During Guarantee Period			

**PART 4 - BID ALTERNATES**

**4.1 GENERAL**

- A. Submit with bid, alternate prices as hereinafter requested stating the total difference in price (add or deduct) from the total base bid amount.
- B. Prices of Alternates shall be the total price without further addition, mark-up, subtraction, change, discount or other changes to determine the cost of work.
- C. Each alternate price shall include provision of work, material, connections, installation, related work, electrical and plumbing connections, control interface work, accessories, testing, adjusting and balancing, freight, rigging, labor, profits, overhead and taxes, and all other items necessary to provide complete and functional installation as required by Contract Document.
- D. Alternate work shall in no way limit the provisions of the Contract Documents, nor change, reduce or limit the Contractor's responsibility to comply fully with the provisions of Contract Documents.

<sup>1</sup> Provide separate line item for each specified item (do not group items)

- E. The Owner reserves the right to accept or reject any or all alternates.
- F. In accepting an alternate, the Owner understands that the bidder has examined the Contract Documents and is aware of all adjustments of affected work necessary to accomplish the stated desired results, whether or not all such adjustments are described within the alternates.

END OF SECTION 200000

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\200000-MECH\_ELEC REQUIREMENTS.DOC

## SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Certain requirements common to all the mechanical and electrical trades (Fire Suppression, Plumbing, HVAC, Electrical, and Tele/Data) are specified in Division 20, Common Mechanical and Electrical Requirements. To avoid repetition, they are not repeated in each relevant Section. These requirements are applicable to the work of this Division, and are hereby incorporated by reference.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Common Div 21 requirements
  - 2. Pipe hangers and fasteners
  - 3. Sleeves, sleeve-seals, stack-sleeves
  - 4. Alarm Devices
  - 5. Pressure Gauges
  - 6. Escutcheons
  - 7. Grout
  - 8. Concrete bases

#### 1.3 METAL SUPPORTS AND ANCHORAGE PERFORMANCE REQUIREMENTS

- A. The design, installation & commissioning of the fire suppression systems shall comply with the following:
  - 1. NFPA Standards, as referenced by the New Jersey Building Code:
    - a. NFPA 13 - Installation of Sprinkler Systems.
    - b. NFPA 14 - Installation of Standpipe and Hose Systems.
    - c. NFPA 20 - Installation of Stationary Pumps for Fire Protection.
    - d. NFPA 25 - Inspection, Testing, and Maintenance of Water-based Fire Protection Systems.
  - 2. Owner Standards.
- B. All system components shall be UL listed and FM approved.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications of Installer



1. Installing Contractor shall have successfully installed multiple automatic sprinkler/standpipe/fire pump systems of similar type and size, for buildings of similar construction and occupancy in New Jersey.

B. Qualifications of System Technician

1. Shop drawings, fabrication plans, system calculations and as-built drawings shall be prepared by or under the direct supervision of a technician with a minimum Level III Certification in Automatic Sprinkler System Layout by the National Institute for Certification in Engineering Technologies (NICET), or a Professional Engineer.
2. A cover letter shall accompany all drawings and calculations identifying the technician or engineer which the documents were prepared by and/or under the supervision of including the person's name, registration number and expiration date.

C. Record Drawings

1. As work progresses and for the duration of the Contract, maintain complete and separate set of prints of Working Plans at job site at all times. Record work completed and all deviations from reviewed fabrication plans clearly and accurately. Include actual locations of existing utilities if they differ from design documents. Valve tags shall be recorded on working plans as installed.

D. Welding Procedure

1. Welding procedure(s) to be used and performance of all welders and welding operators shall meet or exceed the requirements of AWS B2.1 Specification for Welding Procedure and Performance Qualification.
2. Contractor shall have a written quality control program, mark all welds and maintain certified records for all welding in accordance with NFPA 13 requirements.

E. Project Punchlist Procedure

1. When the contract work is substantially complete, the Contractor shall physically walk down the installation and prepare a punchlist containing an itemization of work remaining for 100 percent completion. The punchlist shall be submitted to the Architect prior to request for final project visit.

- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.6 SUBMITTALS

- A. Comply with Division 20, Common Mechanical and Electrical Requirements.
- B. As indicated by each Division 21 Section, submit the following:
  - 1. Qualification Data: For installer and system technician.
  - 2. Welding certificates.
  - 3. Fire-hydrant flow test NFPA 291 format report performed within one (1) year of the calculations which accompany the shop drawings.
  - 4. Product Data: Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 5. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Plans shall include all information required of Working Plans in NFPA 13, 14 & 20.
    - a. Hydraulic Calculations prepared in accordance with the requirements of NFPA 13 and NFPA 14 shall accompany the Working Plans. A separate calculation for each system shall be submitted as indicated by the drawings. All calculations shall demonstrate a minimum 10 psi safety margin, including but not limited to loss through water service piping, backflow preventers, pressure reducing valves, and hose valves.
  - 6. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in the applicable NFPA standards for each system installed.
  - 7. Field quality-control reports.
  - 8. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical

services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Pipe and fittings shall be protected from moisture. Pipe and fittings shall not be stored directly on ground. Pipe and fittings exposed to moisture and showing significant rust shall be removed from site, and shall not be installed.

#### 1.9 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08.

### PART 2 - PRODUCTS

#### 2.1 PIPE HANGERS AND FASTENERS

- A. General Requirements
  - 1. Structural attachments and pipe hangers shall be UL listed and FM approved.
  - 2. Powder driven or pre-expanded inserts shall not be used.
  - 3. Threaded connections shall not be used for attachments to concrete.
- B. Drop in Anchors
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hilti Corp.
    - b. ITW Red Head
    - c. Powers Fastners, Inc.
    - d. Or equivalent.
  - 2. Standard: UL 203.
  - 3. Material: Mild steel with zinc plating.
- C. Concrete Inserts (Cast-In)
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Tolco
    - b. Hilti Corp.
    - c. Powers Fasteners, Inc.
    - d. Or equivalent.
  2. Material: Carbon steel, galvanized
  - D. Hanger Rod
    1. Material: Carbon steel, galvanized
  - E. Manufacturers for Pipe Hangers and Attachments to Steel: Subject to compliance with requirements, provide products by one of the following:
    1. Tolco
    2. Cooper B-Line
    3. Anvil International
    4. Or equivalent.
  - F. Pipe Hangers, piping 3 inches and smaller
    1. Material: Steel, galvanized
    2. Type: Adjustable band type, or clevis
    3. Band type hangers used on CPVC piping shall have flared or beveled edges
  - G. Pipe Hangers, piping 4 inches and larger
    1. Material: Steel, galvanized
    2. Type: Clevis; band hangers shall not be used on piping 4 inches and larger
  - H. Attachments to Steel
    1. Material: Carbon or malleable steel, galvanized
    2. Type: Beam clamp
    3. Beam clamps shall be installed with retaining straps
- 2.2 PIPE, TUBE, FITTINGS AND JOINING METHODS.
- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- 2.3 SLEEVES
- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
  - B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
  - C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

#### 2.4 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Smith, Jay R. Mfg. Co.
  - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
  - 3. Or equivalent.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

#### 2.5 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.
  - 6. Or equivalent.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless Steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

#### 2.6 ALARM DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. To match existing.
- B. Standard: UL 346.
- C. Construction: Corrosion resistant metal base and components; die cast metal red enamel cover with tamper resistant screws; NEMA 4 enclosure rating.
- D. Hazardous Area Applications: NEMA 9 enclosure rating.

- E. Water-Flow Indicators:
  - 1. Type: Electrically supervised; paddle operated with adjustable delay feature.
  - 2. Pressure Rating: 250 psig.
  - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc.
  - 4. Design: Horizontal or vertical.
  
- F. Pressure Switches:
  - 1. Type: Air / water electrically supervised with adjustable delay feature.
  - 2. Pressure Rating: 250 psig.
  - 3. Components: Single-pole, double-throw switch with normally closed contacts.
  - 4. Waterflow Application Design Operation: Rising pressure signals water flow.
  - 5. Supervisory Application Design Operation: Hi or low air / water pressure signals off-normal system pressure.
  
- G. Valve Supervisory Switches:
  - 1. Type: Electrically supervised, with follower / target assembly appropriate for intended valve application.
  - 2. Components: Two Single-pole, double-throw switch with normally closed contacts.
  - 3. Design: Signals that controlled valve is in other than fully open position.
  - 4. Not permitted: Plug-type.

## 2.7 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AMETEK; U.S. Gauge Division.
  - 2. Ashcroft, Inc.
  - 3. Brecco Corporation.
  - 4. WIKA Instrument Corporation.
  - 5. Or equivalent.
  
- B. Standard: UL 393.
  
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
  
- D. Pressure Gage Range: 0 to 250 psig minimum.
  
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
  
- F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.



## 2.8 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prior to preparation of Shop Drawings, perform hydrant flow test in accordance with NFPA 291 to validate the basis of design test data indicated on the Drawings. Indicate results on shop drawing submittal. Promptly report in writing via NFPA 291 reporting format significant deviations between validation test results and basis of design test data.

### 3.2 PIPE SIZING

#### A. General

- 1. Do not perform pipe sizing calculations prior to submitting water supply flow test results for review.
- 2. Do not perform pipe sizing calculations prior to submitting a manufacturer's characteristic pump curve for the fire pump.
- 3. A legible water supply graph sheet shall be included with each hydraulic calculation.
- 4. Elevations used in hydraulic calculations shall have the same datum as the fire protection riser diagram included in the drawings.
- 5. The actual churn pressure of the fire pump as indicated by the manufacturer's characteristic pump curve shall be used in the calculations.
- 6. For systems with pressures exceeding 175 psi, a calculation at no flow conditions shall be submitted to indicate where pressure regulating valves are required. Static pressure shall be indicated for each level on riser diagram.
- 7. Where direct acting pressure regulating valves are used, submittal of calculations shall include a copy of the manufacturer's pressure loss chart with the calculated flow through the valve and resulting pressure drop clearly indicated.

#### B. Standpipes and Feed mains

- 1. Sprinkler/Standpipe feed mains and standpipes upstream of floor control valve assemblies shall be no smaller than as indicated on the drawings.
- 2. As part of the work, confirm the pipe sizing shown on the drawings with hydraulic calculations using the Hazen-Williams correlation in accordance with NFPA 14.
- 3. Calculations shall be in accordance with NFPA 14 using the design criteria shown on the drawings.

4. Standpipe hydraulic calculations shall include a 10 psi pressure loss for standard 2 1/2" fire department angle valves.
5. The calculations shall confirm that the design criteria can be met with a minimum 10 psi "safety factor".

C. Sprinkler piping

1. Sprinkler mains including the floor control valve assembly shall be no smaller than as indicated on the drawings.
2. As part of the work, sprinkler branch piping shall be sized based upon hydraulic calculations using the Hazen-Williams correlation in accordance with NFPA 13.
3. Pipe sizing shall be such that the system demand can be met with a minimum 10 psi "safety factor".
4. Where sprinkler systems are fed by two risers, pipe sizing shall be based upon supply from the hydraulically most remote riser only.
5. Provide additional hydraulic calculations as required when the hydraulically most remote area is not readily apparent (not the geometrically most remote).
6. For gridded systems, a minimum of three calculation areas shall be provided clearly demonstrating that the hydraulically most demanding area is being used.
7. Calculation areas indicated by the design criteria shown on the drawings shall not be reduced due to the use of quick response sprinklers.
8. Hydraulic calculations shall include manufacturer specific pressure loss for seismic separation assemblies and flexible sprinkler connections.

3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Use system components with pressure rating equal to or greater than system operating pressure.
- D. At the end of day all pipe opening shall be covered or capped to minimize the likelihood of introduction of foreign materials into piping. All piping not covered or which has had covering damaged shall be visually inspected internally to confirm no obstructions have been introduced to the piping.
- E. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Install piping to permit valve and component access and servicing.
- I. Install piping at NFPA required minimum slopes; unless more stringent requirements are specified.

- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install piping to allow application of insulation where heat tracing is required.
- M. Install alarm devices on piping.
- N. Install pressure gauges on piping.

### 3.4 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide NFPA required clearance between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes located in stairwells.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide NFPA 13 required clearance.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07.

### 3.5 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07.
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07.

### 3.6 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.7 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

- a. Piping Smaller Than NPS 6 : Cast-iron wall sleeves system.
- b. Piping NPS 6 and Larger: Cast-iron wall sleeves .

2. Exterior Concrete Walls below Grade:

- a. Piping Smaller Than NPS 6 : Cast-iron wall sleeves with sleeve-seal system .
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system .
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

- a. Piping Smaller Than NPS 6 : Cast-iron wall sleeves with sleeve-seal system .
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system .
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

- a. Piping Smaller Than NPS 6 : Galvanized-steel-pipe sleeves .
- b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves .

5. Interior Partitions:

- a. Piping Smaller Than NPS 6 : Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for materials.
- C. Verify final equipment locations for roughing-in.
- D. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.8 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
- 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
  - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
  - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with rough-brass finish.
  - 5. Bare Piping in Equipment Rooms: One piece, cast brass.
  - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
- 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
  - 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
  - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
  - 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
  - 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with rough-brass finish.
  - 6. Bare Piping in Equipment Rooms: Split casting, cast brass.
  - 7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

### 3.9 GROUTING

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.

- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

### 3.10 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

### 3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\210500\_COMMON WORK RESULTS.DOC

## SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Pipe labels.
  - 3. Valve tags.
  - 4. Hydraulic design information sign.
  - 5. General information sign.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.
- E. Information Sign Proofs: Submit proposed completed information signs with all required data, as well as proposed installation details.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each piping system to include in maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Provide custom labels for all equipment, in addition to manufacturer's provided nameplates.
- B. Metal Labels for Equipment:



1. Material and Thickness: Brass, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
5. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

D. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

E. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

D. Pipe-Label Colors:

1. Background Color: Red.
2. Letter Color: White.

### 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping-system abbreviation and 1/2-inch (13-mm) numbers.
  1. Tag Material: Brass, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
  2. Fasteners: Brass wire-link chain, beaded chain, or S-hook.
  3. Valve-Tag Color: Red.
  4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

### 2.4 HYDRAULIC DESIGN INFORMATION SIGN

- A. Material and Thickness: Multi-layer, multi-color plastic, mechanically engraved, 1/8 inch (32 mm) thick.
- B. Letter Color: White
- C. Background Color: Red
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Letter Size: 1/4 inch (6.4 mm).
- F. Adhesive: Contact type permanent adhesive, compatible with label and with substrate.
- G. Sign shall contain the following information at minimum:
  1. Location of design area
  2. Discharge density over the design area
  3. Required flow and residual pressure at the fire pump discharge, or if no pump is present at the connection to the water supply.
  4. Occupancy classification, or commodity classification, maximum storage height, and configuration.
  5. Hose stream allowance.
  6. Installing Contractor's name and contact information.

### 2.5 GENERAL INFORMATION SIGN

- A. Material and Thickness: Multi-layer, multi-color plastic, mechanically engraved, 1/8 inch (32 mm) thick.
- B. Letter Color: White
- C. Background Color: Red

- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Letter Size: 1/4 inch (6.4 mm).
- F. Adhesive: Contact type permanent adhesive, compatible with label and with substrate.
- G. Sign shall contain the following information at minimum:
  - 1. Name and location of facility protected
  - 2. Occupancy classification
  - 3. Commodity classification
  - 4. Presence of high-piled and/or rack storage
  - 5. Maximum height of storage planned
  - 6. Aisle width planned
  - 7. Encapsulation of pallet loads
  - 8. Presence of solid shelving
  - 9. Flow test data
  - 10. Presence of flammable/combustible liquids
  - 11. Pressure of hazardous materials
  - 12. Presence of other special storage
  - 13. Location of auxiliary drains and low point drains on dry pipe and preaction systems
  - 14. Original results of main drain flow test and date conducted
  - 15. Name of installing contractor and contact information

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.2 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

### 3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
  1. Valve-Tag Size and Shape:
    - a. Fire-Suppression Standpipe: 2 inches (50 mm), round.
    - b. Wet-Pipe Sprinkler System: 2 inches (50 mm), round.

### 3.4 INFORMATION SIGN INSTALLATION

- A. Provide separate hydraulic design information sign for each system design criteria.
- B. Hydraulic design information signs shall be permanently mounted at fire service entrance.
- C. General information sign shall be permanently mounted at fire service entrance. Provide second general information sign at location approved by the Fire Department.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\210553\_IDENTIFICATION FOR PIPING AND EQUIPMENT.DOC

## SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 20, Common Mechanical and Electrical Requirements shall apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes and fittings.
  - 2. Sprinkler specialties.
  - 3. Sprinklers.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Contractor shall develop detailed layout and provide, install, and test complete sprinkler system as indicated on plans and specifications.
- C. Delegated Design: Design wet-pipe suppression system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated on Drawings.
- D. Drawings are diagrammatic. They are not intended to be absolute ly precise; they are not intended to specify or to show every offset, fitting and component. The purpose of the drawings is to indicate a system concept, the main components of the system and the approximate geometrical relationships, provide all other components and materials necessary to make the systems fully complete and operational.
- E. Where conflicts between referenced standards, codes, drawings, and specifications exist the most stringent shall apply unless approved in writing by the Engineer.
- F. Location of all visible system components shall be approved by the Architect. Provide additional sprinklers above code required minimums as required by the Architect.
- G. Sprinkler system design shall be approved by authorities having jurisdiction.
- H. Refer to drawings for sprinkler system design criteria.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For wet-pipe sprinkler system.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Wet-pipe sprinkler system, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For Installer and professional engineer.
- C. Approved Wet-pipe Sprinkler Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- G. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing wet-pipe sprinkler system and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Wet-pipe sprinkler equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.

#### 1.8 COORDINATION

- A. Contractor shall coordinate with other trades in accordance with Division 20, Common Mechanical and Electrical Requirements.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.
  - 2. Custom Sprinklers: Provide a minimum of six spare coverplates or sprinklers for each custom finish in addition to spares required by NFPA 13.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with Part 3 "Piping Schedule" for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

#### 2.2 BLACK STEEL PIPE AND FITTINGS

- A. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.
- B. Schedule 10: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Uncoated, Steel Couplings: ASTM A 865/A 865M, threaded.
- E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Grooved-Joint, Steel-Pipe Appurtenances:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Or equivalent.
  2. Pressure Rating: 300 psig minimum.
  3. Standard Epoxy Coated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  4. Standard Epoxy Coated Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- H. Gasketed Hole-cut Outlet Fittings: UL 213, 300 psig minimum pressure rating, Galvanized and standard enamel ASTM A 536 two-piece bolted ductile iron body, inlet gasket seal, with grooved-end or threaded-end outlet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Or equivalent.
- I. Welded Outlet Fittings: UL 213, 300 psig minimum pressure rating, ASTM A 53 carbon steel for joining to Schedule 40 pipe, with grooved-end or threaded-end outlet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Smith Cooper International.
    - c. Tyco Fire & Building Products LP.
    - d. Or equivalent.

## 2.3 PIPING JOINING MATERIALS

- A. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 SPECIALTY VALVES AND ASSEMBLIES

- A. Pressure Reducing Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elkhart Brass Mfg. Company, Inc.
    - b. Potter Roemer Fire Protection Equipment, Division of Morris Group Int.
    - c. Zurn Industries, LLC.
    - d. Or equivalent.

2. Standard: UL 1468
3. Inlet Pressure Rating: 400 psig minimum.
4. Valve Type: In-line, factory-set, direct acting pressure reducing type, with bracket of installation of tamper switch.
5. Body Material: Cast iron or ductile; epoxy coated.
6. End Connections: Threaded or grooved.

B. Pressure Relief Valves

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AGF Manufacturing Inc.
  - b. Cla-Val Co.
  - c. United Brass Works Inc.
  - d. Watts Regulator Co.
  - e. Or equivalent.
2. Standard: UL1478A
3. Pressure Rating: 175 psi minimum
4. Body Material: Bronze
5. Configuration: Vertical installation
6. Connections: Threaded

C. Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AGF Manufacturing Inc.
  - b. Reliable Automatic Sprinkler Co., Inc.
  - c. Tyco Fire & Building Products LP.
  - d. Victaulic Company.
  - e. Or equivalent.
2. Standard: UL's "Fire Protection Equipment Directory" listing and "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AGF Manufacturing Inc.
  - b. Tyco Fire & Building Products LP.
  - c. Victaulic Company.
  - d. Viking Corporation.
  - e. Or equivalent.

2. Standard: UL's "Fire Protection Equipment Directory" listing and "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CECA, LLC.
  - b. Corcoran Piping System Co.
  - c. Merit Manufacturing; a division of Anvil International, Inc.
  - d. Or equivalent.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Tyco Fire and Building Products LP.
  - b. FlexHead Industries, Inc.
  - c. Viking Corporation.
  - d. Victaulic Company,
  - e. Or equivalent.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, with bracket for connection to ceiling grid. Connection shall be minimum 1 inch internal diameter corrugated stainless steel tubing with braided stainless steel jacket. Assembly shall be UL-listed and FM approved.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

## 2.5 SPRINKLERS

- A. Comply with Part 3 "Sprinkler Schedule" for application of sprinklers types, response applications, temperature ratings, and finishes.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Reliable Automatic Sprinkler Co., Inc.

2. Tyco Fire & Building Products LP.
  3. Victaulic Company.
  4. Viking Corporation.
  5. Or equivalent.
- C. General: UL listed and FM approved sprinklers for fire protection service; machined brass or stainless steel frame and deflector; frangible bulb or fusible link operating element; 175 psig minimum pressure rating; 1/2-in and 3/4-in NPT; with frame installation orientation, spray pattern, K-factor, response characteristic, and temperature rating appropriate to each installation application.
- D. Standard: UL's "Fire Protection Equipment Directory" listing and "Approval Guide," published by FM Global.
1. Non-residential spray pattern sprinklers: UL 199.
- E. Installation Orientation: Pendent, upright, and sidewall frames; exposed-pipe, concealed, and recessed.
- F. Standard Spray Pattern Sprinklers: Pendent, upright, and sidewall installation orientation; 5.6 or 8.0 K-factor; quick and standard response; exposed-pipe, recessed, and concealed installation.
- G. Extended Coverage Sprinklers: Pendent, upright, and sidewall installation orientation; 8.0 or 11.2 K-factor; quick and standard response; exposed-pipe, recessed, and concealed installation.
- H. Special Application Sprinklers: Tested and Listed for specific hazards or construction features.
1. Dry-type Sprinklers: Factory assembled pressurized drop nipple and sprinkler assembly intended for protecting areas subject to freezing where supplying branch piping is located in heated areas; pendent and sidewall installation orientation; 5.6 or 8.0 K-factor; quick response; recessed and concealed installation.
- I. Sprinkler Temperature ratings:
1. Ordinary: 135°F - 170°F.
  2. Intermediate: 175°F - 225°F.
  3. High: 250°F - 300°F.
- J. Sprinkler Guards: Listed for use with attached sprinklers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 EXAMINATION

- A. Examine sleeved penetrations through concrete and structural penetrations through steel and verify that they are suitable for intended piping installation.

- B. Examine walls and partitions and verify that they are suitable for installation of piping, cabinets, inlet connections and similar products.
- C. Report conflicts with proposed solutions. Proceed with installation after conflicts have been resolved.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install alarm devices in piping systems.
- J. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- K. Install pressure gages on at each sprinkler test connection and on both sides of pressure reducing valves. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- L. Fill sprinkler system piping with water.
- M. Installation of grooved pipe couplings shall be in accordance with manufacturer's recommendations.
- N. Coupling bolts shall be tightened in accordance with manufacturer's bolt torque requirements.
- O. Excess gasket lubricant shall be removed from coupling housing after bolts are tightened.
- P. Where the use of drilled mechanical outlets is required, the removed coupon shall be attached to the fitting.

- Q. Adjust relief valve(s) such that no water is discharged under normal system working pressure.
- R. Building Expansion Joints - Provide for expansion at building expansion joints with assemblies listed for that purpose. Coordinate the maximum value of building deflection with the appropriate Structural Section of the work.
- S. Beam Clamps - Install all beam clamps with retaining straps.
- T. Fire Stopping - Provide through penetration fire stops in accordance with local building code requirements at pipe penetrations through rated walls, floors and assemblies.

### 3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- G. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install all valves in locations that are readily accessible. Install system control valves in areas that allow for safe fire department access during emergency conditions.
- C. Install indicating valves such that indicator is clearly visible from the floor level below
- D. Install Pressure Reducing valves at zone control assemblies where maximum system pressure will exceed 175-psig.
- E. Adjust relief valves such that no water is discharged under normal system working conditions.

### 3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels with no visible deviation.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Temperature Ratings
  - 1. Coordinate temperature ratings of sprinklers with expected ambient temperatures of installed locations where adjacent to heat producing equipment in accordance with NFPA 13.
- D. Install sprinklers such that cover plate or escutcheon is flush against gypsum or acoustical tile as recommended by manufacturer. Correct sprinklers that are not flush by adjusting them in accordance with the manufacturer's instructions and/or re-installing affected portions of the wall or ceiling assembly if required.
- E. Install sprinklers in accordance with the requirements of NFPA 13 regarding obstructions to sprinkler discharge. All obstructions such as ductwork, piping, lighting, cable trays, floating ornamental ceilings, etc. shall be considered. Adjust sprinkler locations and/or add sprinklers as necessary if obstructions are installed after the installation of the sprinklers and cannot be relocated to accommodate the sprinklers.
- F. Provide and install guards on sprinklers susceptible to mechanical damage.
- G. Provide and install water-shields to prevent cold soldering of intermediate level sprinklers.

### 3.7 USE OF FLEXIBLE SPRINKLER CONNECTIONS

- A. Installation shall be in accordance with manufacturers recommendations.
- B. System hydraulic calculations shall include manufacturer specific equipment length.
- C. Where right angle/elbow connections are used for sprinkler attachment to flexible connection, equivalent length for flexible connection shall include pressure drop through angle/elbow.
- D. Drawings shall clearly indicate locations of all flexible sprinkler connections, manufacturer, length, and outlet type.



- E. Drawing details shall clearly indicate maximum bend radius, maximum number of bends, as well as attachment methods to all ceiling types.
- F. Provide visual indicator of tampering with attachment of sprinkler connection to ceiling via a manufacturer supplied tamper evident label.
- G. Connection to branch shall be made a minimum 45 degrees from horizontal. Where connections off a side or bottom of branchline are required due to coordination, locations shall be clearly indicated or shop drawings and approved by Engineer.

### 3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in Division 21, Section "Identification for Fire Suppression Piping and Equipment".
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Coordinate with fire-pump tests. Operate as required.
  - 7. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

### 3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

### 3.12 PIPING SCHEDULE

- A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  - 2. Schedule 40, black-steel pipe with cut-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 3. Schedule 10, black-steel pipe with roll-grooved ends; painted, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.13 SPRINKLER SCHEDULE

- A. Sprinklers in Light Hazard areas; comply with the following:
  - 1. Type: Standard-spray pattern.
  - 2. Frames: Pendent, pendent-concealed, upright, and sidewall.
  - 3. Response: Quick.
  - 4. K-factor: 5.6.
  - 5. Applications:
    - a. Pendent-concealed, concealed cup and flat cover-plate, white finish; in areas with gypsum or ACT ceilings.
    - b. Upright, without escutcheon, brass finish; in areas open to structure.
    - c. Sidewall, recessed escutcheon, white finish; in gypsum wall partitions.
- B. Sprinklers in Ordinary Hazard areas; comply with the following:
  - 1. Type: Standard-spray pattern.
  - 2. Frames: Upright and pendent.
  - 3. Response: Quick.
  - 4. K-factor: 8.0.
  - 5. Applications:
    - a. Pendent, recessed escutcheon, white finish; in areas with gypsum or ACT ceilings.
    - b. Upright, without escutcheon, brass finish; in areas open to structure.
    - c. Sidewall, recessed escutcheon, white finish; in gypsum wall partitions.
- C. Sprinklers in Extra Hazard areas; comply with the following:
  - 1. Type: Standard-spray pattern.
  - 2. Frame: Upright and pendent.
  - 3. Response: Standard.
  - 4. K-factor: 8.0.

5. Applications:
  - a. Pendent, recessed escutcheon, white finish; in areas with gypsum or ACT ceilings.
  - b. Upright, without escutcheon, brass finish; in areas open to structure.
  
- D. Sprinkler in Areas Subject to Freezing Temperatures, comply with the following:
  1. Type: Dry-pendent Standard-spray pattern.
  2. Frames: Pendent-concealed.
  3. Response: Quick.
  4. K-factor: 5.6 and 8.0.
  5. Applications:
    - a. Pendent-concealed, concealed cup and flat cover-plate, white finish; in Entry Vestibules.
    - b. Pendent, recessed escutcheon, white finish; in Loading Areas.
  
- E. Sprinkler temperature ratings, applications:
  1. Comply with NFPA 13 with respect to maximum ambient temperature, skylights, and proximity to local heat sources.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\211313\_WET PIPE SPRINKLER SYSTEMS.DOC

## SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Certain requirements common to all the mechanical and electrical trades (Fire Suppression, Plumbing, HVAC, Electrical, and Tele/Data) are specified in Division 20. To avoid repetition, they are not repeated in each relevant Section. These requirements are applicable to the work of this Division, and are hereby incorporated by reference.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Mechanical sleeve seals.
  - 3. Sleeves.
  - 4. Escutcheons.
  - 5. Grout.
  - 6. Equipment installation requirements common to equipment sections.
  - 7. Painting and finishing.
  - 8. Concrete bases.
  - 9. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Mechanical sleeve seals.
  - 2. Escutcheons.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
  2. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
  3. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  4. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  1. Manufacturers:
  2. Cascade Waterworks Mfg. Co.
  3. Dresser Industries, Inc.; DMD Div.
  4. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
  5. JCM Industries.
  6. Smith-Blair, Inc.
  7. Viking Johnson.
  8. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
  9. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
  10. Aboveground Pressure Piping: Pipe fitting.

- B. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  - 1. Manufacturers:
  - 2. Cascade Waterworks Mfg. Co.
  - 3. Fernco, Inc.
  - 4. Mission Rubber Company.
  - 5. Plastic Oddities, Inc.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
  - 1. Manufacturers:
  - 2. Eclipse, Inc.
  - 3. Epco Sales, Inc.
  - 4. Hart Industries, International, Inc.
  - 5. Watts Industries, Inc.; Water Products Div.
  - 6. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
  - 2. Capitol Manufacturing Co.
  - 3. Central Plastics Company.
  - 4. Epco Sales, Inc.
  - 5. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
  - 2. Advance Products & Systems, Inc.
  - 3. Calpico, Inc.
  - 4. Central Plastics Company.
  - 5. Pipeline Seal and Insulator, Inc.
  - 6. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Manufacturers:
  - 2. Calpico, Inc.
  - 3. Lochinvar Corp.



- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Manufacturers:
  - 2. Perfection Corp.
  - 3. Precision Plumbing Products, Inc.
  - 4. Sioux Chief Manufacturing Co., Inc.
  - 5. Victaulic Co. of America.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Refer to Division 22.

## 2.7 SLEEVES

- A. Refer to Division 22.

## 2.8 ESCUTCHEONS

- A. Refer to Division 22.

## 2.9 GROUT

- A. Refer to Division 22.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.

- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through penetrations in floors, partitions, roofs, and walls.
- N. Verify final equipment locations for roughing-in.
- O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
  3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03.

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

- C. Field Welding: Comply with AWS D1.1.

### 3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.9 GROUTING

- A. Refer to Division 22.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\220500\_COMMON WORK RESULTS.DOC

## SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Grout.
  - 4. Firestopping.

#### 1.3 PENETRATION FIRE STOPPING ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 DESCRIPTION OF THE FIRE STOPPING WORK OF THIS SECTION

- A. Only tested fire stop systems shall be used in specific locations as follows:
  - 1. Fire stop or fire seal plumbing penetrations for the passage of piping, and other equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
  - 2. Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.

#### 1.5 DEFINITIONS

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

#### 1.6 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops".
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Fire Stops".

- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory
    - a. Fire Stop Devices (XHJJ).
    - b. Fire Resistance Ratings (BXRH).
    - c. Through-Penetration Fire Stop Systems (XHEZ).
    - d. Fill, Voids, or Cavity Material (XHHW).
    - e. Forming Materials (XHKU).
- D. International Fire Stop Council Guidelines for Evaluating Fire Stop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops".
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials".
- G. All major building codes: ICBO, SBCCI, BOCA, and IBC.
- H. NFPA 101 - Life Safety Code.

#### 1.7 QUALITY ASSURANCE

- A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of fire stop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- B. Fire stop System installation must meet requirements of ASTM E814 or UL1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.
- D. Fire stop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those fire stop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Fire Stop Council.

#### 1.8 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL fire stop systems to be used and manufacturer's installation instructions.

- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install fire stop system as described in drawing.
- C. Submit material safety data sheets provided with product delivered to job-site.

#### 1.9 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire stopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its fire stopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility: Assign installation of through-penetration fire stop systems and fire-resistive joint systems in Project to a single sole source fire stop specialty contractor.
- C. The work is to be installed by a contractor with at least one of the following qualifications:
  - 1. FM 4991 Approved Contractor.
  - 2. UL Approved Contractor.
  - 3. Hilti 3rd, Fire Spec, or approved equal Accredited Fire Stop Specialty Contractor
- D. Firm with not less than three (3) years experience with fire stop installation.
- E. Successfully completed not less than three (3) comparable scale projects using similar systems.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

#### 1.11 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Scheduling
  - 1. Schedule installation of CAST IN PLACE fire stop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.



2. Schedule installation of other fire stopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of fire stop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent fire stopping materials from contaminating any adjacent surfaces.

## 1.12 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Fire Stops."
- C. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  1. UL Fire Resistance Directory
    - a. Fire Stop Devices (XHJI).
    - b. Fire Resistance Ratings (BXRH).
    - c. Through-Penetration Fire stop Systems (XHEZ)
    - d. Fill, Voids, or Cavity Material (XHHW)
    - e. Forming Materials (XHKU)
- D. International Fire stop Council Guidelines for Evaluating Fire stop Systems Engineering Judgments
- E. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- F. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- G. All major building codes: ICBO, SBCCI, BOCA, and IBC.
- H. NFPA 101 - Life Safety Code

## PART 2 - PRODUCTS

### 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239 inch minimum thickness; round tube closed with welded longitudinal joint.

## 2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Smith, Jay R. Mfg. Co.
  - 2. Zurn Industries, LLC.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Under deck Clamp: Clamping ring with setscrews.

## 2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.4 FIRESTOPPING

- A. Provide fire stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire stopping under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.
- B. Provide components for each fire stopping system that are needed to install fill material. Use only components specified by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E 814.

1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  2. T-Rating: When penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
- E. Penetrations in Smoke Barriers: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E 814.
1. L-Rating: Not exceeding 5.0 cfm/sf of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration fire stopping with mold and mildew resistance rating of 0 as determined by ASTM G21.
- G. Acceptable Manufacturers
1. Subject to compliance with through penetration fire stop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below, or as approved equal:
    - a. Hilti, Inc., Tulsa, Oklahoma, 800-879-8000, [www.us.hilti.com](http://www.us.hilti.com).
- H. Materials
1. Use only fire stop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
  2. Pre-installed fire stop devices for use with noncombustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls, the following products are acceptable:
    - a. Hilti Cast-In Place Fire Stop Device (CP 680-P).
      - 1) Add Aerator Adaptor when used in conjunction with aerator system.
    - b. Hilti Tub Box Kit (CP 681) for use with tub installations.
    - c. Hilti Cast-In Place Fire Stop Device (CP 680-M) for use with noncombustible penetrants.
    - d. Hilti Fire Stop Speed Sleeve (CP 653) for use with cable penetrations.
    - e. Hilti Fire stop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
    - f. Hilti Fire stop Block (CFS-BL).
  3. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
    - a. Hilti Intumescent Fire Stop Sealant (FS-ONE MAX).
    - b. Hilti Fire Foam (CP 620).
    - c. Hilti Flexible Fire Stop Sealant (CP 606).
  4. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
    - a. Hilti Intumescent Fire Stop Sealant (FS-ONE MAX).

5. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
  - a. Hilti Intumescent Fire Stop Sealant (FS-ONE MAX).
  - b. Hilti Fire Foam (CP 620).
  - c. Hilti Flexible Fire Stop Sealant (CP 606).
6. Non-curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
  - a. Hilti Fire Stop Putty Stick (CP 618).
  - b. Hilti Fire Stop Plug (CFS-PL).
7. Fire stop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
  - a. Hilti Fire Stop Collar (CP 643N).
  - b. Hilti Fire Stop Collar (CP 644).
  - c. Hilti Wrap Strips (CP 648E / 648S).
8. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - a. Hilti Fire Stop Mortar (CP 637).
  - b. Hilti Fire Stop Block (CFS-BL).
  - c. Hilti Fire Foam (CP 620).
  - d. Hilti Fire Stop Board (CP 675T).
9. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - a. Hilti Fire Stop Block (CFS-BL).
  - b. Hilti Fire Stop Board (CP 675T).
10. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
  - a. Hilti Fire Stop Block (CFS-BL).
  - b. Hilti Fire Stop Plug (CFS-PL).
11. Provide a fire stop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1 inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors 2 inches above finished floor level in the following areas:
      - 1) Mechanical equipment rooms/ areas
      - 2) Mechanical Penthouses
      - 3) Operating rooms
      - 4) All laboratory floors
      - 5) In the floor slab above all computer rooms
      - 6) Other wet areas – Cage Wash, Glass Wash.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Comply with requirements for fire stopping specified in Division 07.

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07.
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Comply with requirements for fire stopping specified in Division 07.

### 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

#### A. Use sleeves and sleeve seals for the following piping-penetration applications:

##### 1. Concrete Slabs-on-Grade:

- a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system  
Galvanized-steel-pipe sleeves with sleeve-seal system

- 1) Select sleeve size to allow for 1 inch annular clear space between piping and sleeve for installing sleeve-seal system.

- b. Piping NPS 6: Galvanized-steel-wall sleeves with sleeve-seal system Retain first subparagraph below if using sleeve-seal systems.

- 1) Select sleeve size to allow for 1 inch annular clear space between piping and sleeve for installing sleeve-seal system.

##### 2. Concrete Slabs above Grade:

- a. Piping Smaller Than NPS 6 Insert pipe size: Galvanized-steel-pipe sleeves

- b. Piping NPS 6 Insert pipe size and Larger: Galvanized-steel-pipe sleeves Stack-sleeve fittings

##### 3. Interior Partitions:

- a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

- b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

### 3.4 FIRE STOPPING INSTALLATION

#### A. Preparation

- 1. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

- a. Verify penetrations are properly sized and in suitable condition for application of materials.

- b. Surfaces to which fire stop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

- c. Provide masking and temporary covering to prevent soiling of adjacent surfaces by fire stopping materials.

- d. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of fire stopping.

- e. Do not proceed until unsatisfactory conditions have been corrected.

#### B. Coordination

- 1. Coordinate location and proper selection of cast-in-place Fire Stop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

- 2. Responsible trade to provide adequate spacing of field runs pipes to allow for installation of cast-in-place fire stop devices without interferences.

C. Installation

1. Regulatory Requirements: Install fire stop materials in accordance with UL Fire Resistance Directory.
2. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.
  - a. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - b. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL fire stop systems that might hamper the performance of fire dampers as it pertains to ductwork.
  - c. Protect materials from damage on surfaces subjected to traffic.

D. Field Quality Control

1. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
2. Keep areas of work accessible until inspection by applicable code authorities.
3. Inspection of through-penetration fire stopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
4. Perform under this section patching and repairing of fire stopping caused by cutting or penetrating of existing fire stop systems already installed by other trades.

E. Identification and Documentation

1. The fire stop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration location on the entire project.
  - a. The Documentation Form for through penetrations is to include:
    - 1) A Sequential Location Number
    - 2) The Project Name
    - 3) Date of Installation
    - 4) Detailed description of the penetrations location
    - 5) Tested System or Engineered Judgment Number
    - 6) Type of assembly penetrated
    - 7) A detailed description of the size and type of penetrating item
    - 8) Size of opening
    - 9) Number of sides of assemblies addressed
    - 10) Hourly rating to be achieved
    - 11) Installers Name
2. Copies of these documents are to be provided to the general contractor at the completion of the project.
3. Identify through-penetration fire stop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each fire stop system installation where labels will be visible to anyone seeking to remove penetrating items or fire stop systems. Include the following information on labels:
  - a. The words: "Warning -Through Penetration Fire stop System-Do Not Disturb. Notify Building Management of Any Damage."
  - b. Contractor's Name, address, and phone number.
  - c. Through-Penetration firestop system designation of applicable testing and inspecting agency.



- d. Date of Installation.
  - e. Through-Penetration fire stop system manufacturer's name.
  - f. Installer's Name.
- F. Fire stop documentation manager software shall be used to document, track, and maintain the passive fire stop systems throughout the construction and maintenance phase of the facility. The software solution shall be used to track and document every fire stop system installed on the project and each subsequent addition, change, or removal of the fire stop system. The fire stop documentation shall be managed with cloud-based software which allows the installer to use a standard Smartphone or tablet device (either iOS, Android or Windows capable) to capture the relevant information for the installation. The following data shall be tracked for each penetration within the facility: product installed, system installed, date of installation, location of the penetration including a notation on the 2D plan image, F-rating, name of installer, photo (pre-installation and post-installation), and inspection status. The Owner and/ or Construction Manager may designate additional items to be tracked. The fire stop documentation manager software must perform the following basic functions:
1. Create multiple projects/ facilities, add/create/ remove users for each project, upload documents including UL systems, 2D floor plans, product data, engineering judgments, etc.
  2. Define data to track using pre-defined input fields or creating custom input fields as desired.
  3. Capture multiple photos for each penetration, including a pre-installation and post-installation photo.
  4. Scan QR Code on Hilti identification label to link the program data to a specific penetration location.
  5. Annotate (mark) location of penetration on 2D floor plan.
  6. Create reports by filtering data and utilizing report templates.
  7. Online/ offline (for use in areas where data service is unavailable) synchronization of data between mobile device, online application and cloud-based system.
  8. Ability to transfer ownership of projects from one customer to another from construction phase to facility maintenance.
- G. Permanently attach Hilti identification labels to surfaces adjacent to and within 6 inches (150 mm) of fire stopping edge so labels will be visible to anyone seeking to remove or change penetrating items or fire stopping. Labels shall have a unique QR code for each penetration which can be scanned by the fire stop documentation software to quickly identify the penetration attributes.
- H. Acceptable Software: Hilti CFS-DM, from Hilti Inc., Tulsa, OK. Tel: (800) 879-8000 website: [www.us.hilti.com](http://www.us.hilti.com)
1. Substitutions: Upon submission.
  2. Single Source: Obtain fire stop documentation manager software and fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.
- I. Adjusting and Cleaning
1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
  2. Clean all surfaces adjacent to sealed holes and joints to be free of excess fire stop materials and soiling as work progresses.
- J. Labor Use to Install Fire Stop Systems
1. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

3.5 FIRESTOP SCHEDULE

CONCRETE FLOORS			CONCRETE OR BLOCK WALLS		
TYPE OF PENETRANT	F-RATING (HR)	UL-CLASSIFIED SYSTEM	TYPE OF PENETRANT	F-RATING (HR)	UL-CLASSIFIED SYSTEM
CIRCULAR BLANK OPENINGS	1	FA 0006,CAJ 0055,CAJ 0090	CIRCULAR BLANK OPENINGS	1	CAJ 0055, CAJ 0090
	2	FA 0006,CAJ 0055,CAJ 0090		2	CAJ 0055, CAJ 0090
	3	FA 0006, CAJ 0055, CAJ 0086, FA 0014		3	CAJ 0055, CAJ 0086
SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, FA 1028	SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, WJ 1067
	2	CAJ 1155, CAJ 1291, CAJ 1226, FA 1016, FA 1028, FA 1106, FB1010		2	CAJ 1226, CAJ 1155, CAJ 1291, WJ 1067
	3	CAJ 1155, CAJ 1226, FA 1017, FB 1009		3	CAJ 1226, CAJ 1155, WJ 1041, WJ 1068
	4	CBJ 1037, CBJ 1034, FA 1091		4	CBJ 1034, CBJ 1037, WJ 1041, WJ 1042, WJ 1068
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	FA 2053, FA 2025, CAJ 2109, CAJ 2098, CAJ 2271, CAJ 2167, CBJ 2021, CAJ 2342	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	CAJ 2109, CAJ 2098, CAJ 2167, CAJ 2371, CAJ 2342
	2	FA 2053, FA 2025, FA 2092, CAJ 2109, CAJ 2098, CAJ 2271, CAJ 2167, CAJ 2218, CAJ 2488, CAJ 2570, CBJ-2021, CAJ 2284, CAJ 2371, CAJ 2342		2	CAJ 2109, CAJ 2098, CAJ 2167, CAJ 2218, CAJ 2488, CAJ 2570, CAJ 2371, CAJ 2342
	3	FA 2054, FA 2071, FA 2213, FB 2048, CAJ 2098, CAJ 2109, CAJ 2168, CAJ 2371, CAJ 2342, CAJ 2420		3	CAJ 2109, CAJ 2098, CAJ 2168, CAJ 2371, CAJ 2342
	4	CBJ 2016, CAJ 2017		4	WJ 2057, WJ 2091
SINGLE OR BUNDLED CABLES	1	FA 3007,CAJ 3095,CAJ 3180	SINGLE OR BUNDLED CABLES	1	WJ 3036, CAJ 3095, CAJ 3180, WJ 3060
	2	FA 3007,CAJ 3095,CAJ 3180		2	WJ 3036, CAJ 3095, CAJ 3180, CAJ 3281, WJ 3060
	3	FA 3007,CAJ 3095,CAJ 3180		3	CAJ 3095, CAJ 3180, CAJ 3285
SINGLE INSULATED PIPES	1	FA 5015, FA 5017, CAJ 5090, CAJ 5091, CAJ 5098	SINGLE INSULATED PIPES	1	CAJ 5090, CAJ 5091, CAJ 5061, WJ 5042
	2	FA 5015, FA 5017, CAJ 5090, CAJ 5091, CAJ5090		2	CAJ 5090, CAJ 5091, CAJ 5061, WJ 5042
	3	FA 5016, CAJ 5090, FA 5018		3	CAJ 5090, CAJ 5061
	4	CBJ 5006		4	CBJ 5006, WJ 5028
MIXED PENETRANTS	1	CAJ 8099, CAJ 8056, CAJ 8143	MIXED PENETRANTS	1	CAJ 8099, CAJ 8056, WJ 8007, CAJ 8143
	2	CAJ 8099, CAJ 8056, CAJ 8143		2	CAJ 8099, CAJ 8056, WJ 8007, CAJ 8143
	3	CAJ 8099, CAJ 8056		3	CAJ 8041, CAJ 8056, WJ 8007, CAJ 8099
	4	CAJ 8095		4	CAJ 8095, WJ 8007
WOOD FLOOR			GYPSUM WALL BOARD ASSEMBLIES		
TYPE OF PENETRANT	F-RATING (HR)	UL-CLASSIFIED SYSTEM	TYPE OF PENETRANT	F-RATING	UL-CLASSIFIED SYSTEM
METAL PIPES OR CONDUIT	1	FC 1009, FC 1059	METAL PIPES OR CONDUIT	1	WL 1054, WL 1058, WL 1164
	2	FC 1009, FC 1059		2	WL 1054, WL 1058, WL 1164
				4	WL 1110, WL 1111, WL 1165
NON-METALLIC PIPE OR CONDUIT	1	FC 2232, FC 2030, FC 2071, FC 2160, FC 2127, FC 2128, FC 2389	NON-METALLIC PIPE OR CONDUIT	1	WL 2078, WL 2075, WL 2078, WL 2098, WL 2377, WL 2406, WL2341, WL 2128
	2	FC 2029, FC 2030, FC2071, FC 2128, FC 2127, FC 2160		2	WL 2078, WL 2075, WL 2078, WL 2098, WL 2377, WL 2406, WL2341, WL 2128
				4	WL 2184, WL 2245
SINGLE OR BUNDLED CABLES	1	FC 3012, FC 3044	SINGLE OR BUNDLED CABLES	1	WL 3065, WL 3111, WL 3112
	2	FC 3012		2	WL 3065, WL 3111, WL 3112, WL 3334, WL 3335, WL 3384, WL 3395
				4	WL 3139
INSULATED PIPES	1	FC 5004, FC 5037, FC 5036	CABLE TRAY	1	WL 4011, WL 4019
	2	FC 5004, FC 5037		2	WL 4011, WL 4019
				4	WL 8014
MIXED PENETRANTS	1	FC 8009, FC 8014, FC 8026, FC8025	INSULATED PIPES	1	WL 5028, WL 5029, WL 5047, WL 5096
				2	WL 5028, WL 5029, WL 5027, WL 5096, WL 5047
				4	WL 5073
			MIXED PENETRANTS	1	WL 1095, WL 8013
				2	WL 1095, WL 8013
				4	WL 8014

\*\*CONTACT HILTI FOR CURRENT UL-CLASSIFIED SYSTEM OR ENGINEER JUDGMENT DRAWING: 800-879-6000

**NOTES:**

1. Jobsite conditions of each through-penetration firestop system must meet ALL details of the UL-Classified System selected.
2. If jobsite conditions do not match any UL-classified systems in the schedules above, contact Hilti for alternative systems or Engineer Judgment Drawings - 800-879-8000
3. Where more than one applicable UL-Classified System is listed in the schedules, choose the UL System which is most economical for each through-penetration firestop system.
4. Coordinate work with other trades to assure that penetration opening sizes are appropriate for penetrant locations, and vice versa.
5. For 3-hour rated gypsum walls, contact Hilti for a UL-classified system or engineer judgment drawing - 800-879-8000.

3.6

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\220517\_SLEEVES AND SLEEVE SEALS.DOC

## SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Escutcheons.
  - 2. Floor plates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

#### 2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge or split-plate, stamped-steel type with exposed-rivet hinge.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
    - g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\220518\_ESCUTCHEONS.DOC

## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.
7. Miscellaneous materials.

- B. Related Sections

1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Pipe stands.
  - 4. Equipment supports.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

### 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.



## 2.3 METAL FRAMING SYSTEMS

### A. MFMA Manufacturer Metal Framing Systems

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with in-turned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Metallic Coating: Electroplated zinc hot-dipped galvanized mill galvanized in-line, hot galvanized mechanically-deposited zinc.

### B. Non-MFMA Manufacturer Metal Framing Systems

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with in-turned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
6. Coating: Zinc.

## 2.4 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Internally Threaded Anchor for Installation into Metal Deck: Concrete anchor shall be carbon steel, cast-in type with single internal thread and a sinz/yellow chromate plating. Anchor shall have a protective sleeve, steel flange with pre-drilled additional fastening holes and placement spring for attachment to metal deck, anchor is to be secured by clamping the deck between the steel flange and the protective plastic sleeve. Anchor shall bear the diameter and the manufacturer name on hexagonal head.

- C. Internally Threaded Anchor for Installation into Wood Deck: Concrete anchor shall be carbon steel, cast-in type with single internal thread and a zinc/yellow chromate plating and contained by a plastic flange. Anchor shall have break-off nails for attachment to the surface of wood forms. Anchor will bear the diameter and manufacturer name on hexagonal head.

## 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89 and local codes. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
  - 7. Support of pipe, tubing and equipment shall be accomplished by means of engineered products, specific to each application. Makeshift, field devised methods are not allowed.
  - 8. Comply with CISPI Designation 310-04, CISPI Designation 301-09 and the CISPI Cast Iron Soil Pipe Handbook, regarding auxiliary support for ho-hub cast iron pipe and fitting joints subjected to excessive thrust forces. Use manufactured assemblies with appropriate thrust pressure ratings, rather than field assembled miscellaneous materials.

9. No-hub pipe and fitting coupling joints that are exposed to thrust pressures greater than those recommended by the pipe and fitting manufacturer shall receive auxiliary support by means of appropriate bracing materials, as referred to in CISPI Designation 310-04, CIPSI Designation 301-09 and the CISPI Cast Iron Soil Pipe and Fittings Handbook. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation and shall be installed onto horizontal joints NPS 4 diameter and larger in size. Field devised methods and materials shall not be used to accomplish this application solution.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 for painting.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.



- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.7 SPACING

- A. Refer to individual piping sections for spacing requirements.
- B. Where no requirement is specified elsewhere, pipe hangers and supports shall be per MSS SP-90.
- C. Space pipe hangers and supports in accordance with following tables, with exceptions as indicated herein.

Table 1 – Maximum Horizontal Pipe Hanger and Support Spacing

NOMINAL PIPE OR TUBE SIZE		1		2		3		4		6	7		
		STD WT STEEL PIPE				COPPER TUBE						DUCTILE IRON PIPE	CAST IRON SOIL
		WATER SERVICE		VAPOR SERVICE		WATER SERVICE		VAPOR SERVICE					
in.	mm	ft.	m	ft.	m	ft.	mm	ft.	m				
1/4	(6)					5	1.5	4	1.2	10 FT. (3.0m) MAX SPACING.	5 FT. (3.0m) MAX SPACING EXCEPT MAY INCREASE TO 10 FT. WHERE 10 FOOT LENGTHS ARE INSTALLED. MIN OF ONE (1) HANGER PER PIPE SECTION CLOSE TO JOINT ON THE BARREL. ALSO AT CHANGE OF DIRECTION AND BRANCH CONNECTIONS.		
3/8	(10)	7	2.1	6	1.8	5	1.5	4	1.2				
1/2	(15)	7	2.1	6	1.8	5	1.5	4	1.2				
3/4	(20)	7	2.1	8	2.4	5	1.5	6	1.8				
1	(25)	7	2.1	8	2.4	6	1.8	8	2.4				
1- 1/4	(32)	7	2.1	10	3.0	6	2.1	8	2.4				
1- 1/2	(40)	9	2.7	10	3.0	8	2.4	8	2.4				
2	(50)	10	3.0	10	3.0	8	2.4	8	2.4				
2- 1/2	(65)	11	3.4	10	3.0	9	2.7	8	2.4				
3	(80)	12	3.7	10	3.0	10	3.0	8	2.4				
3- 1/2	(90)	12	3.7	10	3.0	10	3.0	8	2.4				
4	(100)	12	3.7	10	3.0	10	3.0	8	2.4				
5	(125)	12	3.7	10	3.0	10	3.0	8	2.4				
6	(150)	12	3.7	10	3.0	10	3.0	8	2.4				
8	(200)	12	3.7	10	3.0	10	3.0	8	2.4				
10	(250)	12	3.7	10	3.0	10	3.0	8	2.4				
12	(300)	12	3.7	10	3.0	10	3.0	8	2.4				
Vertical Spacing		15	4.5	15	4.5	10	3.0	10	3.0	15' (4.5m)	15' (4.5m)		

Table 1 – Maximum Horizontal Pipe Hanger and Support Spacing

NOMINAL PIPE OR TUBE SIZE		1		2		3		4		6	7		
		STD WT STEEL PIPE				COPPER TUBE						DUCTILE IRON PIPE	CAST IRON SOIL
		WATER SERVICE		VAPOR SERVICE		WATER SERVICE		VAPOR SERVICE					
in.	mm	ft.	m	ft.	m	ft.	mm	ft.	m				
1/4	(6)					5	1.5	5	1.5	10 FT. (3.0m) MAX SPACING.	WITH LEAD AND OAKUM 5 FT. MAX SPACING		
3/8	(10)	7	2.1	6	1.8	5	1.5	6	1.8				
1/2	(15)	7	2.1	6	1.8	5	1.5	6	1.8				

3/4	(20)	7	2.1	8	2.4	5	1.5	6	2.1	EXCEPT MAY INCREASE TO 10 FT. WHERE 10 FOOT LENGTHS ARE INSTALLED. WITH COMPRESSION GASKETS AND NO-HUB, SUPPORT AT EVERY OTHER JOINT UNLESS OVER 4 FEET THEN SUPPORT AT EVERY JOINT. MIN OF ONE (1) HANGER PER PIPE SECTION CLOSE TO JOINT ON THE BARREL. ALSO AT CHANGE OF DIRECTION AND BRANCH CONNECTIONS.
1	(25)	7	2.1	8	2.4	6	1.8	6	2.4	
1-1/4	(32)	7	2.1	10	3.0	6	2.1	6	2.7	
1-1/2	(40)	9	2.7	10	3.0	6	2.1	6	3.0	
2	(50)	10	3.0	10	3.0	8	2.4	10	3.4	
2-1/2	(65)	11	3.4	10	3.0	9	2.7	10	4.0	
3	(80)	12	3.7	10	3.0	10	3.0	10	4.3	
3-1/2	(90)	12	3.7	10	3.0	10	3.0	10	4.6	
4	(100)	12	3.7	10	3.0	10	3.0	10	4.9	
5	(125)	12	3.7	10	3.0	10	30	10	4.9	
6	(150)	12	3.7	10	3.0	10	3.0	10	4.9	
8	(200)	12	3.7	10	3.0	10	3.0	10	4.9	
10	(250)	12	3.7	10	3.0	10	3.0	10	4.9	
12	(300)	12	3.7	10	3.0	10	3.0	10	4.9	
Vertical Spacing		25	7.6	Per Code		10	3.0	Per Code	15' (4.5m)	15' (4.5m)

NOMINAL PIPE OR TUBING SIZE		COLUMNS <sup>(3)</sup> 1, 2, 6, 7		COLUMNS <sup>(3)</sup> 3, 4, 9, 10, 11, 12, 13	
NOMINAL PIPE OR TUBING SIZE		NOMINAL ROD DIA.		NOMINAL ROD DIA.	
in	mm	in	mm	in	mm
1/4	(6)			3/8	M10
3/8	(10)	3/8	M10	3/8	M10
1/2	(15)	3/8	M10	3/8	M10
3/4	(20)	3/8	M10	3/8	M10
1	(25)	3/8	M10	3/8	M10
1-1/4	(32)	3/8	M10	3/8	M10
1-1/2	(40)	3/8	M10	3/8	M10
2	(50)	3/8	M10	3/8	M10
2-1/2	(65)	1/2	M12	1/2	M12
3	(80)	1/2	M12	1/2	M12
3-1/2	(90)	1/2	M12	1/2	M12
4	(100)	5/8	M16	1/2	M12
5	(125)	5/8	M16	1/2	M12
6	(150)	3/4	M20	5/8	M16
8	(200)	3/4	M20	3/4	M20
10	(250)	7/8	M20	3/4	M20
12	(300)	7/8	M20	3/4	M20

NOTE:

- (1) For calculated loads, rod diameters may be sized in accordance with MSS SP-58, Table 3 provided Table 1 and Section 7.3 of MSS SP-58 are satisfied.
- (2) Rods may be reduced one size for double rod hangers. Minimum rod diameter shall be 3/8 in. (M10).
- (3) Columns noted refer to Table 1, maximum horizontal pipe hanger and support spacing.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\220529\_HANGERS AND SUPPORTS.DOC

## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Valve tags.
  - 5. Warning tags.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Marking Services, Inc.

- c. Seton Identification Products.
  2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  3. Letter Color: Black.
  4. Background Color: White.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Marking Services, Inc.
    - c. Seton Identification Products.
  2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
  3. Letter Color: Black.
  4. Background Color: White.
  5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  8. Fasteners: Stainless-steel rivets or self-tapping screws.
  9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Brady Corporation.
  2. Marking Services Inc.
  3. Seton Identification Products.

- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

### 2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Brady Corporation.
  - 2. Marking Services Inc.
  - 3. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

### 2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Brady Corporation.
  - 2. Marking Services Inc.



3. Seton Identification Products.
- B. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  1. Tag Material: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.5 WARNING TAGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Brady Corporation.
  2. Marking Services Inc.
  3. Seton Identification Products.
- B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
  1. Size: Approximately 4 by 7 inches.
  2. Fasteners: Reinforced grommet and wire or string.
  3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  4. Color: Safety yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.4 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
  - 8. Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room, and at intervals no longer than 20 feet.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

### 3.5 PIPE IDENTIFICATION

- A. Provide color-coded pipe identification markers on piping installed under this Section. Pipe markers shall be snap-on laminated plastic protected by clear acrylic coating. Pipe markers shall be applied after Architectural painting where such is required.
- B. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.
- C. In general, 2 inch high legend shall be used for pipe lines 4 inch dia. and larger, and 3/4 inches high legend shall be used for pipe lines 3 inches dia. and smaller.
- D. Color banding shall meet ANSI latest and OSHA requirements.
- E. Markers shall have legends and color coding per the tables below:
- F. Markers are to be applied to all piping, regardless of under jacket colors per the following schedule:

<b>CHART 1</b>			
<b>Basic Plumbing Services</b>			
SERVICE	CODE	MARKER LEGEND	LETTERING & BACKGROUND COLOR
Domestic Cold Water	CW	Potable CW	White on Green
Domestic Hot Water	HW	Potable HW	White on Green
Domestic Hot Water Return	HWR	Potable HWR	White on Green
Main Water Service to Facility	W	City Water	White on Green
Non-Potable Water	NPW	NPW	Black on Yellow
Trap Primer	TP	Trap Primer Supply	Black on Yellow
Gas (Natural) - low pressure	G	Gas ____ inch WC	Black on Yellow
Gas (Natural) -intermediate pressures	G	Gas ____psig	Black on Yellow
Gas (Natural) - high pressure	G	Gas ____psig	Black on Yellow
Gas Vent	GV	Gas Vent	Black on Yellow
Indirect Waste	IW	Per Service	Black on Yellow
Rainwater	RW	Storm Drain	White on Green
Overflow Rainwater	RW(O)	Storm Drain Overflow	White on Green
Sanitary Waste & Vent	San	San, Waste, Vent	White on Black
Force Main (Sanitary Or Storm)	FM	FM "Per Service"	White on Black

<b>CHART 3</b>			
<b>Laboratory Plumbing Services</b>			
SERVICE	CODE	MARKER LEGEND	BACKGROUND COLOR
RODI	RODI	RODI	Black on Yellow
Pure Water Pretreatment Water	PW	Filtered Water	White on Green

G. Chart 4 - Special Piping Services

SERVICE	CODE	MARKER LEGEND	BACKGROUND COLOR
Medical Oxygen	O2	O2	White on Green
Medical Vacuum	MV	MV	Black on White
Medical Air	MA	MA	Black on Yellow

H. The Following Areas shall require all insulated piping to be protected along the entire pipe length with PVC Color Coded jacketed covers (Ceel-Co or Zeston plastic jacket):

1. Penthouse Mechanical Rooms
2. Plumbing Equipment Rooms
3. Mechanical Rooms
4. Main Pipe Corridor without ceilings
5. All Rainwater Leaders (horizontal) in areas without ceilings
6. Shipping Docks
7. Color pattern and system identification legend shall be as in the above schedule for pipe code.
8. This plastic jacket shall include fitting covers and piping covers.
9. Piping to be covered with this plastic jacket shall be insulated and finished as herein specified and then the plastic jacket shall be applied.

- I. Furnish and install one coat of primer and two coats of finish paint to all interior gas piping installed per this contract.
  1. See Division 09 for paint types for interior piping.
  2. Painting shall begin at plumbing side of contract downstream of the utility company gas meter - see exterior painting below for piping exposed to weather.
  3. All gas piping shall be painted "Safety Yellow" per ANSI/ASME identification code 13.1.
  4. Painting shall include all gas vents from vent origin to termination.
  5. Include necessary paint finish touch-up where welding or jointing process has interfered with paint finish
  6. Install labels after paint has cured for a minimum of 5 days.
  
- J. Gas Piping Exposed to Weather or on Roof
  1. Furnish and install OSHA Safety Yellow to exterior and roof mounted gas piping commencing at a starting point one (1) foot below roof to gas pipe termination point on roof in the following manner:
    - a. Primer: Epoxy primer/sealer applied at a spreading rate recommended by the manufacturer (2 coats)
      - 1) Moore M36-00/M37 Polyamide Epoxy Clear Sealer Finish
      - 2) PPG 97-14XX Series Pitt Guard DTR Polyamide Epoxy Clear Sealer Finish
      - 3) S-W Heavy Duty Epoxy B67W300 Series
  
    - b. Intermediate Coat: Epoxy applied at a spreading rate recommended by the manufacturer of 3.0 to 8.0 mils
      - 1) DuPont 25P High Solids Epoxy Mastic
      - 2) S-W Heavy Duty Epoxy B67W300 Series
      - 3) Tnemec Series 66 Hi-Build Epoxoline Polyamidoamine Epoxy
  
    - c. Topcoat: Semi gloss aliphatic polyurethane enamel applied at a spreading rate recommended by the manufacturer to achieve a dry film thickness of 2.0 - 4.0 mils.
      - 1) Moore M73/M75 Aliphatic Acrylic Urethane Semi Gloss
      - 2) PPG 97-8XXX Series Pitthane High Build Acrylic Aliphatic Urethane
      - 3) S-W Corothane II Low VOC Satin Finish B65W200 Series
  
  2. All finish gas piping shall be painted "Safety Yellow" per ANSI/ASME identification code 13.1.
  3. Include necessary paint finish touch-up where welding or jointing process has interfered with paint finish
  4. Install labels after paint has cured for a minimum of five (5) days.
  5. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions detrimental to formation of a durable paint film. Provide finish coats that are compatible with primers used.

### 3.6 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
  
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Tags, Valves, Equipment and Instruments
  - a. Upon completion of work, attach engraved laminated plastic tags to all valves, and instrumentation. Equipment shall bear a stamped stainless tag. Tags shall have black characters on white face, consecutively numbered and prefixed with letter P for general valves. Tags shall bear the number used in the P&IDs for those items so marked.
  - b. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8 inch thick.
  - c. Tags shall be at least 1 inch diameter with numerals at least 3/8 inch high and attached by S hooks and chains.
  - d. Nameplates, catalog numbers and rating identifications shall be securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.
  - e. Non-potable water outlets shall be identified with permanently attached yellow color code or 4 inches high triangle tag reading, "water unsafe."
  - f. Coordinate numbering system with existing piping tags as not to duplicate numbers.
2. Valve-Tag Size and Shape:
  - a. All Plumbing and Piping Services that are part of this contract 1-1/2 inches round.
3. Valve-Tag Colors:
  - a. Comply with the same colors as indicated for Pipe Labels
4. Letter Colors:
  - a. White.

### 3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\220553\_IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.DOC

## SECTION 220719 - PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:

1. Insulation materials
2. Accessory materials
3. Factory applied jackets
4. Tapes
5. Securements

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  2. Detail attachment and covering of heat tracing inside insulation.
  3. Detail insulation application at pipe expansion joints for each type of insulation.
  4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  6. Detail application of field-applied jackets.
  7. Detail application at linkages of control devices.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- B. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Type A: Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Certain-Teed.
    - b. Johns Manville.
    - c. Owens Corning.
    - d. Pittsburgh Corning Corporation.
  - 2. Molded Fibrous Glass Pipe Insulation: Comply with ASTM C 547, Type 1, Grade A, and ASTM C 585, for sizes required and of a type suitable for installation on piping systems as required. One of the following types shall be used:
  - 3. For indoor systems operating at temperatures from 0°F (-18°C) to +850°F (454°C):
    - a. Owens Corning™ Fiberglas™ Insulation with SSL II® Positive Closure System.
  - 4. For systems operating below ambient (32°F (0°C) to +65°F (18°C)) temperature:
    - a. Owens Corning™ VaporWick® Pipe Insulation. (see Plumbing Pipe Insulation – VaporWick® Pipe Insulation)
  - 5. Block Insulation: ASTM C 552, Type I.
  - 6. Special-Shaped Insulation: ASTM C 552, Type III.
  - 7. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
  - 8. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Type B: Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. K-Flex USA.



- H. Type C: Mineral-Fiber, Preformed Pipe Insulation:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Manson Insulation Inc.
    - d. Owens Corning.
- I. Type G: Protective Shielding Pipe Covers,:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Engineered Brass Company.
    - b. Insul-Tect Products Co.
    - c. McGuire Manufacturing.
    - d. Plumberex Specialty Products, Inc.
    - e. Truebro.
    - f. Zurn Industries, LLC.
  2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.2 ACCESSORY MATERIALS

- A. Accessories: Provide accessories per insulating system manufacturer's recommendations, including the following:
1. Closure Materials: Butt strips, bands, wires, staples, mastics, adhesives, and pressure-sensitive tapes.
    - a. Mold resistant mastics are recommended for chilled water applications.
  2. Field-Applied Jacketing Materials: Sheet metal, plastic, canvas, fiberglass cloth, insulating cement, PVC fitting covers.
  3. Support Materials: Hanger straps, hanger rods, saddles, support rings, and high density inserts.
- B. Adhesives for Indoor Applications: VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 FACTORY-APPLIED JACKETS

A. y-applied jackets are indicated, comply with the following:

1. ASJ: White, Kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C 1136, Type II.

B. Jacket Types

TYPE	STYLE	MATERIALS
Type 1:	All Service Jacket	Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Jacket shall be heavy duty fire retardant material with glass fiber reinforcing and self-sealing lap. Jacket will be factory applied to the insulation. Jacket shall have neat, white Kraft finish or white vinyl suitable for painting, with bead puncture resistance of 50 units minimum. Vapor barrier shall be .001 inch aluminum foil adhered to the inner surface of the jacket. Permeance shall not exceed 0.02 perms. Jacket shall be Owens-Corning Fiberglass "ASJ-SSL" or Manville flamesafe "AP-T".
Type 2:	PVC Jackets:	Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket One piece, pre-molded type equal to Johns Manville Zeston 2000/300 Series PVC 20 or 30 mil jacketing and PVC fitting covers. All jackets shall follow manufacturers to comply with temperature of service piping. Jackets shall meet USDA compliance standard for all food handling
Type 3:	Color Coded PVC Jacket	Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket Same as type 2 above but color coded generally in rooms without ceilings. Color Jacket to be applied to all pipe, fittings and valves in the specified area in the schedule table below. See section 220553 Identification for specific colors, these colors are to be contiguous on the piping system in the areas scheduled.
Type 7	Protective Shielding Piping Enclosures for barrier free trap and water piping under fixture	<u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: <u>Truebro.</u> <u>Zurn Industries, LLC.</u> Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements. Furnish protective shielding to all Emergency Eyewash units where water waste and trap are exposed and are exclusively selected for Barrier Free Use.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Avery Dennison Corporation, Specialty Tapes Division.
  - b. Compac Corporation.
  - c. Ideal Tape Co., Inc., an American Biltrite Company.
  - d. Knauf Insulation.
  - e. Venture Tape.
2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Compac Corporation.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Venture Tape.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.

## 2.5 SECUREMENTS

- A. Bands:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. ITW Insulation Systems; Illinois Tool Works, Inc.
    - b. RPR Products, Inc.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch 3/4 inch wide with wing seal or closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

- C. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. C & F Wire.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use de-mineralized water.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches OC.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches OC.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches OC.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:



1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 INSTALLATION OF MINERAL-FIBER INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches OC.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.9 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.12 PIPING INSULATION SCHEDULE

Piping System	Insulation Type	Thickness Inch	Jacket	Notes
Water Service Cold, Up To Meter - Water Supply	A C	1 1	Type 2	
All Cold Water Supply	A C	1/2 3/4"	Type 1	Note 4 Note 5
All Hot Water Supply And Return less than 1-1/2 inches	A C	1 1	Type 1	Note 4 Note 5
All Hot Water Supply And Return greater than 1-1/4 inches	A C	1-1/2 1-1/2	Type 1	Note 4 Note 5

Piping System	Insulation Type	Thickness Inch	Jacket	Notes
All Insulated Piping In Mechanical Rooms, Corridors Without Ceilings,	Per This Table	Per This Table	Type 3	Note 5
Roof Drains And Horizontal Rainwater, Including Overflow Drainage System	A C	1/2 1	Type 1	Note 3 Include Drain Bodies Note 5
Floor Drains, Traps, And Sanitary Drain Piping Within 10 Feet Of Drain Receiving Condensate And Equipment Drain Water Below 60 deg F	A B C	1-1/2 3/4 1/2	Type 1	Note 3
Hot Service Drains And Vents	A C	1-1/2 1	Type 1	Note 3 Note 5
Piping Exposed To Freezing (Water)	A C	2	Type 5	
Piping Exposed To Freezing (Sanitary)	A C	2	Type 5	
Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, And Stops For Plumbing Fixtures For People With Disabilities	G	1/2	Type 7	Package System Only Includes EW&S Where Designated For Barrier Free Use.
<p>Supplemental Notes</p> <p>Note 1: Two layers of 1 inch with staggered joints. Provide stainless steel 1/2 inch steel bands, 12 inches on center, apply 1 foot hexagonal mesh over insulation and 1/2 inch thick coat of insulating cement troweled smooth. Apply glass cloth jacket and size with one brush coat of lagging adhesive.</p> <p>Note 2: The [xxx] contractor will furnish and install heat trace tape, prior to insulation installation. Raychem self-regulating Winter Guard Plus [xxx] [8] watts per foot with failure alarm</p> <p>Note 3: Insulation shall include drain sump body and all horizontal piping to, and including the elbow down to vertical.</p> <p>Note 4: Unless noted otherwise this section pertains to ALL piping in a specified system, including in-chase or in-shaft piping.</p> <p>Note 5: The Following Areas shall require all insulated piping to be protected along the entire pipe length with PVC Color Coded jacketed covers (Ceel-Co or Zeston plastic jacket), this applies to exposed piping. If the piping is located above a ceiling, then use white PVC jackets and labels</p> <ul style="list-style-type: none"> <li>• Penthouses</li> <li>• Plumbing Equipment Rooms</li> <li>• Mechanical Rooms</li> <li>• Main Pipe Corridor without ceilings</li> <li>• All Rainwater Leaders (horizontal) in areas without ceilings</li> <li>• Shipping Docks</li> <li>• MEP Walkways or Interstitial Spaces</li> <li>• Other areas without hung ceilings</li> <li>• Color pattern and system identification legend shall be as in the above schedule for pipe code.</li> <li>• This plastic jacket shall include fitting covers and piping covers.</li> <li>• Piping to be covered with this plastic jacket shall be insulated and finished as herein specified and then the plastic jacket shall be applied.</li> </ul>				

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\220719\_PLUMBING PIPING INSULATION.DOC

## SECTION 221110 - COMMON PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Piping materials
  - 2. Under-building-slab and aboveground pipes, tubes, and fittings inside buildings.
  - 3. Dielectric fittings

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.
- B. All Pipe, Fittings, Valves and Sundries contained in this specification section. All piping systems shall be submitted as a single piping submittal package with labels tagged consistent with the pipe index found in Part 2 of this spec.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. All Product shop drawings and submittal sheets for all pipe, fittings, valves, equipment, appurtenances, and systems included in this section
- B. System purging and disinfecting activities report.
- C. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule Index and Pipe Tables." Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 UNDER-BUILDING-SLAB AND ABOVEGROUND PIPES, TUBES, AND FITTINGS INSIDE BUILDINGS

PIPE CLASS A10	1/2 inch to 2 inches	2-1/2 inches and Larger
All pipe, fittings, and valves used in this distribution system and installed after January 4, 2014 must comply with the new Federal Mandate known as the "Reduction of Lead in Drinking Water Act-2014". Therefore, after the enactment date of 1/4/14, all products installed must comply. Any product pipe, fittings or valve installed after the enactment date that does not comply, shall be removed and changed by this contractor at his/her own expense to comply with the Federal Law		
PIPE	Seamless copper water tube, drawn temper, Type L. ASTM B-88. See Note 1.	Seamless copper water tube, drawn temper, Type L. ASTM B-88. See Notes 2 and 5.
FITTINGS	Wrought copper, solder-joint. ASME B16.22	Ductile iron coupling with copper alkyd enamel paint coating, ASTM A-536. Grade "EHP" EPDM elastomer gasket rated -30F to 250F, ASTM D-2000. Equal to Victaulic Style 607 coupling. ASTM B-75 or ASTM B-152 copper alloy fittings or ASTM B-584 grooved end cast bronze fittings per UNS C89836 or C92200.
JOINTS	ASTM solder filler material shall be lead free to comply with the federal mandate of 2014. ASTM B-813 liquid or paste flux. Soldering procedures shall comply with ASTM B-828.	Rolled groove prepared and assembled in accordance with manufacturer instructions.
MECHANICAL JOINTS	Cast copper alloy unions, hexagonal stock with ball-and-socket joint, solder joint ends. ASME B16.18.	ANSI Class 150 flange adapter equal to Victaulic Style 641 for connections to flanged equipment. ANSI B16.1 dimensions.
BRANCH CONNECTIONS		Victaulic Mechanical T Style 622
<p><b>VALVES</b> Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Apollo, Watts, Milwaukee, Nibco, or Conbraco.</p>		
Gate Valve	Use ball valve.	Outside stem and yoke resilient wedge flanged gate valve, lead free model, <b>Watts Series 408-OSYRW</b> . This valve intended for main shutoff in compliance with local water department regulations.
Ball Valve	All bronze lead free, 2-piece, full port, PTFE seats, solder end connections. 600 psig WOG. Apollo 77BLF-100, Watts Milwaukee, <b>Watts LF-B6081</b> .	Class 125, cast iron body, FDA epoxy coated. Full port, flanged ends, stainless steel ball and stem. ANSI B16.1 flange dimensions. <b>Watts G-4000-FDA</b> series, Apollo IBV.
Butterfly Valve	<p>Equal to Victaulic Series 608 butterfly valves bubble-tight shut-off to 300 psi with the following features:</p> <ul style="list-style-type: none"> <li>• Lead free design</li> <li>• Join to the piping system with Style 607 couplings.</li> <li>• Double-seal disc design with a resilient elastomeric coating bonded to the ductile iron disc core. Grade CHP fluoro-elastomer rated -30 deg F to 250 deg F.</li> <li>• Double-seal disc design with a resilient elastomeric coating bonded to the ductile iron disc core.</li> <li>• The disc actuated by a manual lever, gear.</li> <li>• Dead end service provided to full working pressure in both directions.</li> <li>• Sealing and positive shut-off are accomplished by a double ring seal.</li> </ul>	

PIPE CLASS A10	1/2 inch to 2 inches	2-1/2 inches and Larger
Check Valve	Lead Free Bronze body and clapper, solder ends, 200 WOG. Apollo 163 SLF Series, Watts LFWCV-CVS series, Milwaukee, Stockham.	Iron body, bronze mounted, flanged ends, 200 WOG. Apollo 910F Series, Milwaukee F-2974-M, Stockham G-931.
Balancing Valve	2 inches and Smaller. 300 psi threaded, soldered or Permalynx push-to-connect ends, non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4-turn digital readout hand wheel for balancing, hidden memory feature with locking tamper-proof setting. Watts series LFCSM-61-S, or approved equal by Bell & Gossett or Armstrong.	2-1/2 inches or Larger. 250 psi Flanged or 350 psi Grooved ends, ASTM A536 ductile iron body, all other metal parts of Ametal® brass copper alloy, EPDM o-ring seals. 8, 12, or 16 turn digital readout hand wheel for balancing, hidden memory feature with locking tamper-proof setting. Apollo 58B, Watts, or approved equal by Bell & Gossett or Armstrong.
<b>SPECIALTY VALVES</b>		
Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Apollo, Watts, NIBCO, R&W Caleffi.		
Balancing Valve With Flow Meter	Application: Inlet of all Tempering Valves, Inlet of Building How Water Re-circulating pumps. Integral automatic balancing circuit valve with integral flow meter display. Sizes range from 1/2 inch to 2 inches selected per flow rate. Equal to <b>Caleffi Corporation model 132</b> Quick Setter low lead balancing valve with flow meter.	
Balancing Valve With Temperature Gauge	Application: at all circuit returns to the hot water circulated return main. Integral automatic balancing circuit valve with integral cartridge flow rate. Sizes range from 1/2 inch to 2 inches selected per flow rate. Equal to <b>Red &amp; White Valve Corporation series 9500 Lead Free</b> . Provide separate downstream temperature gauge in conformance with spec section 220519 "Meters and Gauges"	
Drain Valve	All bronze, 2 piece, RPTFE seats, thread x solder end connections. 600 Psig WOG. <b>Apollo 70LF-100-HC</b> , Milwaukee, Watts. Hose thread adapter with cap and chain. Provide hose end vacuum breaker to be lead free.	
Strainers	Bronze body, threaded or solder ends to suit, stainless steel screen, 400 pound WOG. Apollo 59LF series	
Pressure Reducing Valve	Control Valve, Apollo A127LF, Pilot Operated. <b>Watts LF-M115</b> , CLA-VAL. Valves to be lead free.	
Solenoid Valve	2-way solenoid valves are internally piloted with assisted lift valves featuring lead-free Brass, stainless steel construction and FKM seal material. Coordinate voltage with electrician. <b>Omega Series SV-6100</b> , <b>Granzow Series W</b> lead free	
<b>NOTES:</b>		
<ol style="list-style-type: none"> <li>Below grade water piping 3 inches and smaller shall be Type K copper with brazed joints, BcuP filler alloy. ANSI/AWS A5.8. Procedures shall be per ANSI/AWS B2.2.</li> <li>Contact between dissimilar metals shall be made with di-electric couplings or di-electric flanges. Contact between ferrous and stud bolts and bronze flanges shall be electrically insulated with non-metallic washers.</li> <li>Provide mechanical joint connections to all equipment such as water heaters, pumps, compressors, etc.</li> <li>Above grade water piping 8 inches and larger shall be Schedule 40 galvanized steel piping with galvanized fittings and grooved joints.</li> <li>Valves used for throttling of flow shall be butterfly type with memory stop. Ball valves shall not be acceptable on hot water return piping</li> <li>Valves shall be provided with Buna-N, TFE, or EPDM seats suitable for the service intended.</li> <li>The pressure classifications for valves specified herein are working steam or water, oil, gas (WOG) pressure ratings.</li> <li>Lever handles on all valves shall be color coded in conformance with ANSI Standard A-13.1</li> <li>Shut-off valves on the incoming water service and on the discharge of the water meter shall be a gate valve or other full-way valve</li> <li>Ball valves used to isolate emergency equipment shall be equipped with a "latch lock lever" #(-27) and be pad locked in the open position.</li> </ol>		

PIPE CLASS A10	1/2 inch to 2 inches	2-1/2 inches and Larger
<p>11. Balancing valves for the domestic hot water system shall be lead free bronze body or a metal copper-alloy construction, with differential read out ports, concealed memory stop with digital hand wheel, and drain port. Installation shall be in accordance with manufacturers' recommendations.</p> <p>12. Grooved joint couplings shall incorporate an angled-pattern bolt pad design to provide confirmation of joint integrity upon visual metal-to-metal bolt pad contact with slight offset and no torque requirement. Tongue and recess designs may only be used if a torque wrench is utilized (IAW published installation instructions) and each coupling is either tagged or marked with indelible ink to indicate the actual torque value attained.</p> <p>13. A factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. Contractor shall remove and replace any improperly installed products. Gaskets used on potable water systems shall be UL classified in accordance with ANSI/NSF-61 for both hot (180 deg F) and cold (86 deg F). Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.</p>		



PIPE CLASS A11	Gas Piping	
Item	2 inches and Smaller	2-1/2 inches and Larger
PIPE	Schedule 40 Carbon Steel ASTM A53 Grade B, A106 Grade A, or ASTM A120.	Schedule 40 Carbon Steel ASTM A53 Grade B, ASTM A106 Grade A, or ASTM A120.
FITTINGS	Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern	Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding
UNIONS	Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends	Use Flanges.
FLANGES	<p>Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:  Material Group: 1.1.  End Connections: Threaded or butt welding to match pipe.  Lapped Face: Not permitted underground.  Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.  Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground</p>	
VALVES	<p>Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Watts Regulator, Apollo, Serd Audco, Resun, Nordstrom, AY McDonald  Note: All valves used for gas shall be approved for use by the State Fuel Gas Code and/or the State Plumbing Board.</p>	
Plug/Gas Cock Valves	Bronze body and plug manually operated low pressure (2 psig or less) natural or propane gas valve for use indoors at ambient temperatures of 32 to 125 degrees Fahrenheit Basis of Design: <b>.A.Y. McDonald 10558</b>	Iron Body, Greasable and Lubricated Tapered Plug, rectangular port, regular opening, Flanged End, WOG, 125 psi SWP Valve shall be equal to R&M Energy Systems Inc. <b>Resun Model #1431 200 psi.</b>
Solenoid Valves	<p>Intrinsically safe specifications completely encapsulated within the enclosure using epoxy material. Valve shall be furnished with NEMA 4x conduit hub and shall be explosion proof design. Operate at 120 VAC with an intrinsic safety barrier.  Basis of Design: ASCO gas shutoff valve series <b>EF-8210 brass body valve.</b>  Note: for substituted valves that require pneumatics, furnish 40 micron filtered 1/2" compressed air for valve operation</p>	
Ball Valves	Bottom loaded pressure stem valve rated at 600 psi WOG. Basis of Design: Watts B-6000-UL-MassApollo 70-100-07 series, <b>Watts FBV-3C</b>	<p>Ball valves shall be of the floating-ball design providing bi-directional, tight shutoff in accordance with MSS SP-72. The valves shall be rated at 150# WSP/300# WOG. Bodies shall be ductile iron per ASTM A536, With ANSI Class 150 raised-face flanges. The interior and exterior of the body shall be UL certified polyester powder coated to meet NSF/ANSI 61 and NSF/ANSI 372. The ball shall be PFA infused stainless steel, with a stainless steel blowout-proof stem. The seats and body seals shall be PTFE. The stem seal shall be PTFE, externally adjustable chevron type. Valves shall be equipped with locking handles as standard. Valves shall be equipped with 2" manual gear operators.  Basis of Design: <b>American Valve, Inc Series 4000D</b></p>

PIPE CLASS A11	Gas Piping	
Item	2 inches and Smaller	2-1/2 inches and Larger
Check Valves	All available sizes: 150# Class, bronze swing check valve. Aluminum disc, screwed cap, threaded or flanged ends, lifting lug for 3 – 8 inch valves. Basis of Design: <a href="#">Eclipse Inc. Series 1000</a> .	
Fire Safety Gas Automatic Shutoff Valve	<p>Inner-Tite Corporation fire valve, Class 125 cast iron body swing check valve for installation in the natural gas service line of large volume gas users. The fire valve shall shut off the flow of gas in the event of a fire.</p> <p>In the event of a fire, the exposed heat collecting fins on the fuse plug transmit the elevated temperature to the fusible metal alloy within the plug. The solder is engineered to melt at a temperature of 165 deg F. When this occurs, it releases the Shut-off Cover which then closes and stops the flow of gas.</p> <p>Conforms to MSS-SP-71, Type 1. Conforms to ANSI B16.10 and B16.1.</p> <p>Note: The plumbing contractor shall seek a product approval variance for the use of this valve for this project only. (Massachusetts Projects Only)</p> <p>Basis of Design: <a href="#">Inner Tite Flange Fire Valve</a></p>	
PRESSURE REGULATING DEVICES	<p>Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:</p> <ul style="list-style-type: none"> <li>• American Meter Company.</li> <li>• Eclipse Combustion, Inc.</li> <li>• Fisher Control Valves and Regulators</li> <li>• Itron Valve</li> <li>• Sensus</li> <li>• Maxitrol Company.</li> <li>• Pietro Fiorentini Company</li> </ul> <p>Note: All valves used for gas shall be approved for use by the State Fuel Gas Code and/or the State Plumbing Board.</p> <p>When installing regulators for condensing gas boilers or water heaters, strictly observe manufacturer’s installation guidelines. Assure the regulator manufacturer sizes the device such that lockup or droop does not occur when condensing units start and/or quickly stop. Assure the regulator position is per the equipment (boilers, water heaters, AHU) manufacturers and the regulator manufacturer standards for all circumstances. Install all pilot lines in strict conformance with manufacturer requirements.</p>	
Main Gas Service Regulators	<p>Coordinate with the Utility for gas service regulators. The service regulator is to be furnished and installed by the gas utility</p> <p>Basis of Design: <a href="#">Piero Fiorentini Norval</a> or <a href="#">Dival</a> series regulator selection program link</p>	
Line Pressure Regulator – (5 psig to low pressure)	<p>Comply with ANSI Z21.80.</p> <p>Body and Diaphragm Case: Ductile iron or die-cast aluminum.</p> <p>Springs: Zinc-plated steel; interchangeable.</p> <p>Diaphragm Plate: Zinc-plated steel.</p> <p>Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.</p> <p>Orifice: Aluminum; interchangeable.</p> <p>Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.</p> <p>Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.</p> <p>Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.</p> <p>Overpressure Protection Device: Factory mounted on pressure regulator.</p> <p>Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.</p> <p>Over Pressure Device: 4 port dual model device</p> <p>Maximum Inlet Pressure: 5 psig, (34.5kPa)</p> <p>Basis of Design: <a href="#">Pietro Fiorentini Governor Overprotection Device (ODP) Operator/Monitor</a></p>	

PIPE CLASS A11	Gas Piping	
Item	2 inches and Smaller	2-1/2 inches and Larger
	<p>model  Maximum inlet pressure 10 psig (69 kPa)    Pietro Fiorentini Governor Overprotection Device (ODP) model two stage pressure cut model</p>	
Line Pressure Regulator – (2 psig to low pressure)	<p>Comply with ANSI Z21.80.  Body and Diaphragm Case: Ductile iron or die-cast aluminum.  Springs: Zinc-plated steel; interchangeable.  Diaphragm Plate: Zinc-plated steel.  Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.  Orifice: Aluminum; interchangeable.  Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.  Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.  Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.  Overpressure Protection Device: Factory mounted on pressure regulator.  Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.  Maximum Inlet Pressure: 2 psig (13.8 kPa) ]  Basis of Design: Pietro Fiorentini Governor model</p>	
Rooftop Equipment Regulator	<p>Comply with ANSI Z21.80.  Body and Diaphragm Case: Ductile iron or die-cast aluminum.  Springs: Zinc-plated steel; interchangeable.  Diaphragm Plate: Zinc-plated steel.  Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.  Orifice: Aluminum; interchangeable.  Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.  Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.  Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.  Overpressure Protection Device: Factory mounted on pressure regulator.  install a vent from the regulator to above the snow line – see venting below.  Maximum Inlet Pressure: 2 psig (13.8 kPa) ]  Basis of Design: Pietro Fiorentine Governor Model</p>	
Appliance Pressure Regulators	<p>: Comply with ANSI Z21.18.  Body and Diaphragm Case: Die-cast aluminum.  Springs: Zinc-plated steel; interchangeable.  Diaphragm Plate: Zinc-plated steel.  Seat Disc: Nitrile rubber.  Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.  Factory-Applied Finish: Minimum three-layer polyester and polyution, if approved by authorities having jurisdiction.  Maximum Inlet Pressure: 1 psig.  Basis of Design: Maxiflow RV series, Pietro Fiorentini Governor series</p>	
Regulator Vents	<p>This applies to all regulators that require a vent line:  Atmospheric Vent    install a vent from the regulator to above the snow line and terminate with a 180 degree turn down and insect screen.</p> <ul style="list-style-type: none"> <li>if the service regulator has a stainless screen in the vent already and when the installer has to extend the vent above the snow line, remove and relocate the factory screen to the end of the vent extension, otherwise field-install, a 16 mesh stainless-steel screen</li> </ul>	

PIPE CLASS A11	Gas Piping	
Item	2 inches and Smaller	2-1/2 inches and Larger
	in opening at the end of the vent line	
SPECIALTY ISOLATION AND CONTROL COMPONENTS	Note: All valves used for gas shall be approved for use by the State Fuel Gas Code and/or the State Plumbing Board.	
Emergency Gas Shut-Off With Access Box (Manual)	Master gas valve box constructed of all heavy gauge stainless steel. Interior finish bead. Front flange <u>without door</u> . The interior finish to be polished to a satin finish. Logos strip "Master Gas Valve" which is black bakelite tag with 1/2 inch high white letters and self-adhesive logo sent loose for installation in field. Gas Shutoff Ball Valve, T Handle with Locks. Approved ball valve as specified above. Furnish permanent metal tag that readily identifies the piping system controlled by the valve.	
Emergency Gas Shut-Off In Safety Station	Safety Station Enclosure furnished by the Architect. Gas Shutoff Ball Valve. Furnish and install approved ball valve as specified above with T Handle with Locks. Furnish permanent metal tag that readily identifies the piping system controlled by the valve Take out	
NOTES:		
<ol style="list-style-type: none"> <li>For Laboratory Gas Piping Systems, Supply an Emergency Gas Shut-Off Ball Valve to Each Lab.</li> <li>Provide a branch ball valve and positive silent check valve on each pipe branch within each laboratory on the gas pipe floor sub-main downstream of the Lab module cabinet gas shutoff valve</li> <li>Provide two wrenches for each gas cock size.</li> <li>Provide two Kitchen solenoids, one interlocked with the hood fire suppression system and a second interlocked with the carbon monoxide detection system, see Vanderweil Engineers Inc. detail for wiring. Field-verify voltage solenoid valve requirements with kitchen supplier.</li> <li>The Contractor, at his option, may weld piping down to 1-1/4 if permitted by local codes.</li> <li>All welders for gas piping must be certified per the requirements of Division 22.</li> <li>Where multiple gas regulators are installed, regulators shall be marked with a metal tag designating the building or areas being supplied. For all underground installation, Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.</li> </ol>		

PIPE CLASS A17	GALVANIZED STEEL PIPING	
Item	2 inches and Smaller	3 inches and Larger
PIPE	Schedule 40 Galvanized Steel. ASTM A53 Grade B, A106 Grade A or A120.	Schedule 40 Galvanized Steel. ASTM A53 Grade B, ASTM A106 Grade A or ASTM A120.
FITTINGS	Screwed malleable iron 125 PSI galvanized.	Grooved ductile iron 150 PSI galvanized.
UNIONS	Screwed 150# malleable iron A105 Grade II, galvanized.	Coupling shall act as union.
FLANGES	150# raised face, screwed, A105 galvanized.	Flange adapter Victaulic Style 741.
GASKETS	1/16 inch red rubber, wire inserted. 150 raised face and 125 flat face gasket.	Selected for intended service.
GATE VALVES	Use Ball Valve	Use Butterfly Valve Victaulic series 300
BALL VALVE	2-piece all bronze, full port, PTFE seats thread end, 4 bolt 600 PSI CW working press. Milwaukee Ba-300, Apollo 77F, Watts B-6080. Victaulic series 721	150# class, carbon steel body, stainless steel ball and stem, Teflon seat and seal, flanged. Jamesbury 5150-31-22. Apollo CS Flanged Series. Or use Butterfly Valve for sizes 3"

PIPE CLASS A17 GALVANIZED STEEL PIPING		
		and greater
BUTTERFLY VALVE	Use ball valve	150# rated, full lug type wafer ductile iron body, alum/bronze disc, stainless steel stem, EDPM or NPR Seat. DeZurik series BOS-US, Victaulic Series 761 with ductile iron body, Crane Centerline series
DRAIN VALVE	600 WOG bronze ball valve, NPT x 3/4 inch hose with gasketed cap and chain. Milwaukee BA-100-4, Apollo 77F with 3/4" hose connection and cap.	
CHECK VALVES	For water - Horizontal swing, composition disc, all bronze, threaded ends, 200 PSI Wp. Basis of Design: Milwaukee 509, Jenkins 352c, Stockham B319. For compressed air – Apollo 61-700 series, Victaulic series 716H	Flanged swing check, class 125 for decelerated disc closure and installation at no more than 45 degrees from horizontal, flanged end, 200 PSI WP. Basis of Design: Jenkins 477-L, Stockham G931-L&W., Victaulic series 716
NOTES:		
<p>1. When steel comes in contact with dissimilar material, provide di-electric couplings or dielectric flanges. Contact between ferrous stud bolts and bronze flanges shall be electrically insulated with non-metallic washers. Provide union connections to all pneumatically operated equipment.</p>		

PIPE CLASS D10	CAST IRON PIPING	
Item	Above Grade	Below Grade
PIPE	3 inches and Larger: Hubless Cast Iron Soil Pipe, Service Weight. ASTM-A-888, CISPI 301. Type L Copper Tubing. ASTM B8872. See Note 1.	2 inches And Larger: Hub And Spigot Cast Iron Soil Pipe, Extra Heavy. ASTM A-74 or Service Weight if Code Approved. Piping shall be Asphalt or Coal Tar Pitch Coated.
FITTINGS	3 inches and less Hubless Cast Iron Fittings, Service Weight. ASTM-A-888, CISPI 801. or Wrought Copper DWV Fittings. See Note 1	2 inches and Larger: Hub and Spigot Cast Iron Fittings, Extra Heavy or service weight ASTM A-74. Asphalt or Coal Tar Pitch Coated. DWV Pattern.
CAST IRON SOVENT FITTINGS	For sanitary waste systems only, Cast Iron Sovent system and fittings are acceptable. <u>Cast Iron Sovent DWV system</u> installed in accordance with approved construction plans and specifications in compliance with criteria set forth by "Cast Iron Sovent Design Manual #802" as published by Conine Manufacturing Co., Inc. The Cast Iron Sovent Aerator and De-aerator fittings shall be in compliance with ASME standard B16.45-1998.	
JOINTS	Hubless Cast Iron: Heavy Duty Stainless Steel Band Coupling with Neoprene Gasket. Bank Torque of 80 Foot-Pounds. 15 PSIG Pressure Rating. Husky SD 4000 or Clamp-All Hi-Torq 80. See Note 2. Copper: 95/5 Solder.	Neoprene Compression Gaskets Conforming to ASTM C-564.
BACKWATER VALVE – PIT STYLE	Pit Style Backwater Valve: Duco Cast Iron Gravity with Bronze Backwater Valve and CI Secured Grate. Provide flashing clamp. Polished Bronze Face. J.R. Smith Co. 7000,, Zurn, Josam, Watts.	
BACKWATER VALVE – IN LINE	Cast Iron Gravity Flow Type, Bronze Mounted, Hub End. Exterior shall be Mastic Coated, Bolted or Extended Cover in Accordance with Installation Parameters. J.R. Smith Co. 7012 - 7022, Josam 67500, Zurn Industries Z-1095, Watts, BV-200.	
BACKWATER – MANUAL SHUTOFF GATE	Duco Cast Iron Gravity Flow Type, Bronze Mounted with removable wheel handle. J.R. Smith Co. 7150, Josam, Zurn Industries, Watts.	
NOTES:	<ol style="list-style-type: none"> <li>CISPI 310 no-hub couplings will not be accepted as equal to manufacturers listed.</li> <li>Copper tube and fittings shall not be used on urinal wastes.</li> <li>Piping through electric rooms: sanitary, storm, and vent piping through electric rooms shall be sleeved through a sufficiently sized Schedule 10 galvanized sleeve piping with grooved style fittings and couplings. Extend dual wall piping to a distance of 1 foot beyond the exterior on each side of the electric room. Terminate with a closure method comprised of a caulked joint at each end with a closed 3/4 inch ball valve available to monitor the containment area of the piping system</li> </ol>	

PIPE CLASS D11	SANITARY OR STORM FORCE MAIN PIPING	
Item	3 inches and Smaller	4 inches and Larger
PIPE	Schedule 40 Galvanized Steel. ASTM A53 Grade B, A106 Grade A or A120.	Schedule 40 Galvanized Steel. ASTM A53 Grade B, A106 Grade A or A120.
FITTINGS	Screwed Cast Iron 125 PSI Galvanized.	Grooved Malleable Iron 125 PSI Galvanized.
UNIONS	Screwed 150# Malleable Iron A105 Grade Ii, Galvanized.	Use Flanges.
FLANGES	150# Raised Face, Screwed, A105 Galvanized.	150# Raised Face Galvanized Uniflange, ASTM A181, Grade I. 150# Flat Face for Cast Iron Valve.

PIPE CLASS D11	SANITARY OR STORM FORCE MAIN PIPING	
Item	3 inches and Smaller	4 inches and Larger
GASKETS	1/16 inch Red Rubber, Wire Inserted. 150 Raised Face And 125 Flat Face Gasket.	
GATE VALVE	2-1/2 inches and Smaller: 125# Class, All Bronze, Rising Stem, Solid Disc, Solder Ends Screwed Bonnet, Solid Disc, Screw Ends Milwaukee 148, Apollo 101T, Stockham B-114.	3 inches and Larger: 125# Class, Iron Body, Os&Y Bronze Mounted, Flanged Ends. Milwaukee F-2885-M, Apollo 611F, Stockham G-623, Watts 408 OSY-RW.
CHECK VALVE	Horizontal Swing, Composition Disc, All Bronze, Threaded Ends, 200 PSI Wp. Milwaukee 509, Apollo 161T, Stockham B319.	Outside Lever And Weight Swing Check, Ibbm for Installation at no more than 45 degrees from horizontal, Flanged End, 200 PSI Wp. Jenkins 477-L, Stockham G931-L&W, Apollo 910 FLW.
SUMP EJECTOR SYSTEM	Alternative option for valve arrangement at the outlet of duplex sewage ejectors and/ or sump pump systems: Victaulic Series 318 Sump Ejector. System complete with Victaulic Series 317 AWWA check valve supplied with arm and spring configuration and Victaulic series 365 plug valve with lever handle.	

## 2.3 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. **A. Y. McDonald Mfg. Co.**
    - b. **Watts; a Watts Water Technologies company.**
    - c. **Wilkins.**
    - d. **Zurn Industries, LLC.**
  2. Standard: ASSE 1079.
  3. Pressure Rating: 125 psig minimum at 180 deg F for low pressure piping and 150 psig 250 psig for high systems where the operating pressure exceeds 150 psig.
  4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. **Watts; a Watts Water Technologies company.**
    - b. **Wilkins.**
    - c. **Zurn Industries, LLC.**
  2. Standard: ASSE 1079.
  3. Factory-fabricated, bolted, companion-flange assembly.
  4. Pressure Rating: 125 psig minimum at 180 deg F 150 psig 175 psig 300 psig match system working pressure.
  5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. **Advance Products & Systems, Inc.**
    - b. **Calpico, Inc.**
    - c. **Central Plastics Company.**



- d. **Pipeline Seal and Insulator, Inc.**
  - 2. Non-conducting materials for field assembly of companion flanges.
  - 3. Pressure Rating: 150 psig.
  - 4. Gasket: Neoprene or phenolic.
  - 5. Bolt Sleeves: Phenolic or polyethylene.
  - 6. Washers: Phenolic with steel backing washers.
  
- E. Dielectric Nipples:
  - 1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. **Elster Perfection Corporation.**
    - b. **Grinnell Mechanical Products.**
    - c. **Precision Plumbing Products.**
    - d. **Victaulic Company.**
  - 2. Standard: IAPMO PS 66.
  - 3. Electroplated steel nipple complying with ASTM F 1545.
  - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
  - 5. End Connections: Male threaded or grooved.
  - 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPE SCHEDULE INDEX

SERVICE	CODE	MAXIMUM SERVICE OPERATING LIMITS		PIPE CLASS	PIPE MATERIAL
		(psig)	Temp (°F)		
City or Service Water Entrance Piping	CW	100	250	A05	Type K Copper or D1CL
Domestic Cold Water	CW	100	250	A10 A20	Type L Copper
Domestic Hot Water	HW	100	250	A10 A20	Type L Copper
Domestic Hot Water Return	HWR	100	250	A10 A20	Type L Copper
Non-Potable Water	NPW	100	250	A10 A20	Type L Copper
Trap Primer	TP	100	250	A10 A20	Type L Copper
Gas (Natural)	G	50	70	A11	C. Steel
Gas Vent	GV	50	70	A11	C. Steel
Indirect Waste (above ground)	IW	Gravity	80	A17 A10	G. Steel Copper
Sleeve for Interior Under-ground Natural Gas Piping	G-S	50	120	A17	G. Steel
Natural Gas Exterior	G	30	73.4	A19 A19a	Polyethylene Corrugated SS

SERVICE	CODE	MAXIMUM SERVICE OPERATING LIMITS		PIPE CLASS	PIPE MATERIAL
		(psig)	Temp (°F)		
					PE sleeve
<p><b>GENERAL PIPE SPEC NOTES:</b></p> <ol style="list-style-type: none"> <li>1. Each valve type shall be the product of a single manufacturer. Each system shall be provided with valves as required by code and shown on the drawings and shall be installed to facilitate operation, replacement and repair.</li> <li>2. Provide access panels for concealed valves behind non-removable ceilings or walls.</li> <li>3. Provide shut-off valves on supply piping to individual pieces of equipment.</li> <li>4. Provide pipe dope, Teflon tape, wax rings, neoprene gaskets and other jointing compounds as required by best standard practice and only on service as recommended by manufacturer.</li> <li>5. Apply putties and jointing compounds for plumbing fixtures and trim as recommended by manufacturers.</li> <li>6. Valves on insulated piping systems shall be equipped with extended handles to accommodate insulation thickness.</li> <li>7. All piping insulation and materials installed in return air plenums shall be plenum rated. Thermoplastic piping systems are hereby prohibited in return air plenums.</li> <li>8. Piping routed through metal stud or wood stud partitions: provide centering such that piping does not come in contact with metal studs and also protection of piping systems routed horizontally through metal stud or wood stud partitions where the piping crosses a stud. Sleeve type protection shall be used to prevent damage to the lateral piping by the use of screws/nails/fasteners. Provide pre-manufactured products equal to puncture solution, or on site sleeves.</li> </ol>					

3.2 EARTHWORK

- A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Piping Installation
  1. Install piping approximately as shown on the drawings and as directed during installation by the General Contractor or the Architect.
  2. Piping shall be installed as straight and direct as possible forming right angles or parallel lines with building walls, other piping and neatly spaced.
  3. The horizontal runs of piping, except where concealed in partitions, shall be installed as high as possible.
- B. Piping or other apparatus shall not be installed in such a manner so as to interfere with the full swing of the doors and access to other equipment.
- C. The arrangement, positions and connections of pipes, fixtures, drains, valves, and the like, indicated on the drawings shall be followed as closely as possible, but the right is reserved by the General Contractor or the Architect to change locations and elevations to accommodate the work, without additional compensation for such change.
- D. It shall be possible to drain the water from all sections of each cold, and hot water piping system. Pitch piping back to drain valves.
- E. Screwed piping of brass or chrome plated brass shall be made up with special care to avoid marring or damaging pipe and fitting exterior and interior surfaces.

- F. Screwed pipe and copper tubing shall be reamed smooth before installation.
- G. All exposed piping in connection with fixtures and where exposed on finished walls or to view, shall be chrome plated. Where chrome plated piping is installed, cut and thread pipe so that no unplated pipe threads are visible when the work is completed.
- H. Remove and replace with new materials, any copper or brass piping (chrome plated or unplated) and valves showing visible tool marks.
- I. Vertical risers shall be firmly supported by riser clamps, properly installed to relieve all weight from the fittings.
- J. The pipe and fittings shall be manufactured in the United States of America and in accordance with the Commercial Standards, American National Standards Institute and American Society of Testing Materials.

#### 3.4 GRAVITY PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping free of sags and bends.
- F. Install piping to allow application of insulation.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- I. Install steel piping according to applicable plumbing code.
- J. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- K. Be responsible for checking each pipe for alignment, centerline elevation and invert grade for underground installations.
- L. At times when work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe or fittings. Pipe laid through rock excavation shall rest on a six-inch layer of well-compacted sand.

- M. The Sanitary (waste and vent), and storm drainage piping three inches and smaller in diameter shall pitch a minimum of 1/4 inch per foot, and piping four inches and larger in diameter shall pitch a minimum of 1/8 inch per foot.
- N. The vent stacks shall be connected as shown and extended through the roof a minimum of 18 inches. Waste and vent pipes shall be concealed unless otherwise noted.
- O. Every fixture shall be separately trapped and the traps must be vented unless an approved battery or wet vented system is being installed. Floor drains shall be considered as a fixture.
- P. Vents shall be connected to the discharge of each trap in the sanitary system, thence carried individually to a point above the flood level of the fixture before connecting with any other vent pipes. Pitch the branch vents back to the fixtures.
- Q. The vents passing through the roof shall be a minimum size of four inches in diameter.
- R. Cleanouts shall be provided in drainage piping at changes in directions, at foot of stacks or other required points so that all portions of the lines will be readily accessible for cleaning or rodding out.
- S. The maximum horizontal distance between cleanouts; in piping four inches in diameter and smaller shall not be more than 50 feet apart; in piping five inches in diameter and larger shall not be more than 100 feet apart.
- T. Traps on sanitary piping not integral with fixtures and in accessible locations shall be provided with a brass trap screw protected by the water seal, and will be regarded as a cleanout.
- U. Test tees with brass cleanout plugs shall be provided at the foot of all vertical waste and storm drainage stacks and at each floor. Wherever cleanouts on vertical lines occur concealed behind finished walls, they shall be extended to back of finished wall and a wall plate shall be provided.

### 3.5 JOINT CONSTRUCTION (GRAVITY DRAIN STORM AND VENT SYSTEMS)

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

- F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

### 3.6 PRESSURE PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube and ductile iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5 when soil is of corrosive nature.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 and with requirements for drain valves and strainers in this section for water piping specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. When water pressure exceeds 80 psig, install water-pressure-reducing valves downstream from shutoff valves.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 22.

- P. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22.
- Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22.

### 3.7 JOINT CONSTRUCTION (PRESSURE PIPING SYSTEMS)

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.8 NATURAL GAS SYSTEMS

- A. All piping shall be cut accurately to measurements obtained at the site and shall be installed without springing or forcing due to inaccurate measurements or improper hanger installation
- B. Piping shall be done by licensed gas fitter (as required by Code).
- C. Gas piping shall pitch to drain and shall have drip pockets at least 6 inches long with removable caps at low points.
- D. Gas Isolation Valves
  - 1. Provide a gas cock valve at each branch run out from main or riser serving gas outlets. This shall include all branches from the gas main and further branches from gas sub-mains. These

- requirements will be strictly enforced by the local plumbing inspector. This requirement shall take precedent over general arrangement drawings. Therefore the following is called for:
2. Provide a gas shutoff valve at each Tee on both outlets of the Tee in a run of piping
  3. Provide a gas shutoff valve at each piece of equipment
  4. Gas valves or cocks shall not be concealed and shall be readily accessible for inspection and repair
  5. Every branch line from a main shall be furnished with a branch valve (no exceptions) and shall be taken off the top of main using such fittings as may be required by structural obstructions or other installation conditions. All service pipes, fittings, and valves shall be kept at sufficient distance from other work to permit not less than 1 inch between finished coverings on other service piping.
- E. Provide union connection between shut-off cock and equipment to permit disconnection of equipment
- F. Piping shall be securely fastened, separately hung and shall not support any other weight or piping. Piping dropping in concrete block walls shall be factory wrapped for corrosion protection.
- G. Welded piping shall conform to the latest requirements of the New Jersey Fuel Gas Code.
- H. All piping shall be supported independently and securely fastened to the building structure with appropriate anchors and pipe hangers. In general, all lines shall be installed above ceilings in finished spaces.
- I. All piping shall be cut true and threaded or welded. Cap all open ends of piping to prevent the entrance of debris when work on this system is complete or the work day has ended.
- J. Provide individual vents from regulators, pressure switches and reliefs on factory packaged equipment gas trains at all equipment located on this system. It is this contractor's responsibility to extend all vents to atmosphere terminal at a safe location in conjunction with the fuel gas code.
- K. Gas piping and safety devices shall meet requirements of NFPA No. 54 and shall be subject to inspection and approval of State Gas Regulatory Board.
- L. All pipes shall be run parallel and graded evenly to low points. A serviceable drip leg of at least six inches in length shall be provided at each low point, at every connection to a piece of equipment, and at the base of each riser.
- M. All exterior gas piping, valves and fittings shall be protected and covered with Tapecoat H35 Gray corrosion protection tape with integral primer and adhesive. All fittings and joints shall be wrapped with similar protective tape.
- N. Provide valved pressure gauge assemblies at each main gas service entrance, at each water heater, boiler, emergency or standby generator, incinerators, HVAC rooftop units and all other major pieces of equipment utilizing gas. Each pressure gauge assembly shall be individually valved, include a snubber and shall have a dial range that would locate the system pressure as close to the approximate mid-point on the dial range as possible. Assembly shall be similar to TRERICE Model 760B, 2-1/2 inch diameter gauge, 735-2 valve and 872-1 snubber.
- O. Piping system shall be purged with 100 psi compressed air to remove dirt and debris.
- P. Pressure test gas piping system with air, carbon dioxide or nitrogen pressure test at not less than 10 psi gage for a period of 24 hours with no decrease in pressure. For welded piping and for piping carrying gas at pressures exceeding 14-inches of water column pressure, the test pressure shall be at least 60 psig for a period of 24 hours with no decrease in pressure. If a decrease in pressure is detected, soap or bubble test joints for leaks, repair or replace as required, and retest.

- Q. Gas piping connections to all equipment shall include a gas shutoff valve, drip leg, union fitting and pressure gauge as well as a swing joint consisting of at least two 90 degree elbows at all HVAC equipment

### 3.9 GAS SERVICE, METER, VENTS AND PIPING

- A. Gas meter and piping to meter from gas main will be provided by Gas Company. Pay charges associated with Gas Company installation. Gas piping provided under this Section, not by gas company; shall begin at building side of gas meter.
- B. Provide pressure reducing valve between meter and building piping, as required by Gas Company, piped and vented to outside of building.
- C. Provide full size isolation valve at the gas meter outlet.
- D. Provide an aluminum or plastic valve tag stating the gas pressure downstream of the gas meter.

### 3.10 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: per manufacturers recommendations

### 3.11 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4. Use dielectric flanges flange kits nipples.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.12 EXAMINATION OF VALVES

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.



- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.13 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for butterfly and gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.
- G. Install valve tags. Comply with requirements in Division 22 for valve tags and schedules.

### 3.14 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Division 22.
- B. Comply with requirements for pipe hanger, support products, and installation in Division 22.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
  - 3. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - 4. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
  - 5. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 7. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  6. NPS 6: 10 feet with 5/8-inch rod.
  7. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  7. NPS 6: 12 feet with 3/4-inch rod.
  8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- J. Install supports for vertical steel piping every 15 feet.
- K. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.15 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.16 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22.
- B. Label pressure piping with system operating pressure.

### 3.17 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
  2. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  4. Piping Tests:
    - a. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.18 TESTING AND ADJUSTING - GENERAL

A. Scope

1. Test and adjust plumbing systems as specified and as required by authorities that have jurisdiction. Perform tests recommended by manufacturers of materials and equipment. This requirement may be waived by Architect.
2. Testing, balancing, and adjusting shall in no way relieve guarantee requirements.
3. Furnish instruments, equipment, material, and labor necessary to conduct tests.
4. All systems shall be thoroughly adjusted for perfect intended operation. All mechanical equipment shall be adjusted for flow, temperature, etc. of fluid. The entire hot water circulation system shall be thoroughly balanced so hot water draw from fixtures shall be as quickly available as possible. Pumps, relief valves and pressure reducing valves shall be adjusted as required by the Engineer. Submit in writing to the Engineer upon completion of this work that it is completed and ready for use.

B. Before date of acceptance, furnish Architect with certificates of testing and inspection indicating approval of authorities having jurisdiction and conformance with requirements of Contract Documents.

C. General

1. Submit proposed test procedures, recording forms, and test equipment for review before testing.
2. Notify Architect and authorities involved at least 48 hours before testing and inspection.
3. Do not paint, cover or conceal work before testing, inspecting and obtaining approval; this includes backfilling and application of insulation.
4. Costs of repairs and restoration of work of other trades and of existing building surfaces or material damaged during cleaning or testing shall be borne by trade performing cleaning or testing.

D. No tests shall be started until systems have been cleaned as described under Cleaning paragraph. Provide temporary piping and connections for testing, flushing, or draining systems to be tested.

1. Repair or replace leaks, damage and defects that result from tests to like-new condition. Remove and replace defective materials with acceptable materials.
2. Piping and joints shall be made tight without caulking. Continue tests until systems operate without adjustments and repair to equipment or piping.
3. Provide testing instruments, force pumps, gauges, equipment and labor necessary to conduct tests. Instruments used for testing and balancing shall have been calibrated within six months before balancing. Instrument calibration shall be certified.
4. Submit six copies of complete testing and balancing report to Architect for review.

E. Final test shall be made after vertical and horizontal pipes and roughing-in have been run and before sewer or fixture connection is made.

1. After soils, wastes, and storm lines, etc. have been installed, outlets shall be temporarily plugged up.
2. Test piping and check for leakage.
3. Retesting after leaks are repaired shall be at no additional cost.

F. Pressurized Piping Systems

1. Leak tests shall be conducted in accordance with ANSI applicable codes and as specified herein.
2. Test piping of various systems before covered or furred in.
3. Tests shall be witnessed by Architect and pronounced satisfactory before pressure is removed or any water drained off.

4. Equipment shall be valved off or removed during test if equipment pressure rating is less than test pressure.
5. Retest systems after leaks are repaired within Contract Price.

G. Potable Water System Test

1. Certification of the potable water system integrity shall be required where separate systems of potable and non-potable water are provided to supply plumbing fixtures.
2. Fill potable water system to capacity with clean clear water. Introduce water at top of piping system (hot and cold). During filling, introduce green food coloring dye into piping system. A floor-by-floor survey shall be conducted. Operate each outlet (hot and cold) connected to potable water system until coloring has been observed. A method of maintaining the level of water and coloring shall be employed in order to make-up the drawn off amounts. A survey sheet shall indicate each floor and the room number sequentially.
3. This survey is required to be performed after all pressure testing and flushing of the piping system but before sterilization, further it is required that all fixtures connected to the potable water system be installed prior to the test.

H. Examine Part 2 for supplemental testing requirements.

3.19 TESTING: PIPING SYSTEMS

A. General

1. Piping systems shall be subjected to testing water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested, required head or pressure shall be maintained until joints are inspected.
2. Tests shall be witnessed by inspector having jurisdiction and the Architect with 48-hour notice given these authorities.
3. Equipment, material and labor required for testing of various systems or part thereof shall be provided by Plumbing Contractor.

B. Sanitary, Other Waste, Vent and Rain Water Conductor Systems

1. Water test shall be applied to drainage systems either in their entirety or in sections as required, after rough piping has been installed.
2. If applied to entire system, openings in piping system shall be tightly closed, except the highest opening, and system filled with water to point of overflow.
3. If system is tested in sections, each opening shall be tightly closed except highest opening in the section under test, and each section shall be filled with water but no section shall be tested with less than a 10 foot head of water.
4. In testing successive sections, at least upper 10 feet of next preceding section shall be tested so that no joint of piping in building, except the uppermost 10 feet of the system shall be submitted to a test of less than a 10 foot head of water.
5. Water shall be kept in system for at least 30 minutes before inspection starts; the system shall then be made tight at all points.
6. Points of drainage systems tested with air instead of water shall be tested by attaching an air compressor testing apparatus to suitable opening and, after closing all other inlets or outlets, forcing air into systems until a uniform gauge pressure of 5 psi or sufficient pressure to balance a column of mercury 10 inches high. Pressure shall be held without introduction of additional air for a period of at least 15 minutes.

C. Water Piping Systems

1. Upon completion of water supply systems or section thereof, as required, system shall be tested and proved tight under 1.5 times the operating system pressure and a minimum of 150 psi. Gauge shall be located on lowest new floor and pressure shall hold for a period of one hour without introducing additional water. Water used for testing shall be from a potable source of supply.
2. Filtered water piping system shall be tested with filtered or distilled water to a pressure of 100 psi for one hour.

D. Natural Gas Piping Systems

1. Upon completion of gas piping system or section thereof, as required, test by attaching an air compressor testing apparatus to any suitable opening and, after closing all other inlets or outlets, force air into the system until a uniform pressure of at least 10 inches mercury or 3 lb. gauge for a period of no less than 60 minutes for each 500 cubic feet of pipe volume without showing any drop in pressure. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device calibrated to read in increments of no greater than 1/10 lbs.
2. Test all elevated pressure gas piping at 15 psi for 24 hours. Pressure shall be measured with a mercury manometer, slope gauge, or an equivalent device calibrated to read in increments of no greater than 1/10 lbs.

E. Testing Summary

System	Test Medium	Test Pressure	Test Duration
Drainage and Vent (All Systems)	Water	10 feet	30 minutes
Water (All Systems)	Water	150 psig min or 1.5 operating pressure	1 hour
Natural Gas (High Pressure)	Air	15 psig min or 1.5 operating pressure	24 hours
Natural Gas (Low Pressure)	Air	10 inch mercury minimum for each 500 cubic feet of pipe volume	1 hour
Ejector Discharge/Pumped Piping System	Water	50 psig min. or 1.5 times system pressure	1 hour

- F. Defective Work: If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material. No caulking of screwed joints or holes shall be acceptable.

G. Additional Tests

1. Provide additional tests such as smoke pressure tests as required by regulations or as directed by authorities making the inspection.
2. Provide for any repeated test as directed by the Architect, to make all systems tight as required.
3. Visual inspections of joints and valves shall be made as directed by the Architect.

3.20 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

5. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
6. Adjust calibrated balancing valves to flows indicated.
7. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
8. Remove and clean strainer screens. Close drain valves and replace drain plugs.
9. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
10. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.21 BALANCING OF HOT WATER SYSTEMS

#### A. Building Distribution System

1. All circuits and sub circuits shall be flow and temperature balanced such that hot water positive flow is achieved in each branch circuit of the building hot water systems
2. See drawing detail sheets and specification section pipe table A10 for flow and balancing valve spec options. The specified products indicate either integral flow or flow/temperature balancing devices, assure the installed devices meet these specifications
3. Indicate on a riser diagram the type of balancing device use, method of calibration and proposed flow in each branch circuit of the hot water piping network for each hot water system

#### B. Building Main Hot Water Distribution Pumps

1. Balance flows to the main Thermostatic Hot Water Mixing Valves according to manufacturer's instructions
2. Provide plastic tags on each circuit indicating the flow and balancing valve position to the Mixing valves and then to the water heaters

#### C. Submissions

1. Submit a report indicating the actual flow and temperature in each circuit described in item C above. The report shall designate the following:
  2. Time to achieve hot water at the remote hot water faucet in the circuit
  3. Hot water temperature achieved
  4. Setting on circuit setter
5. For the circuits at the outlets of hot water circulation pumps, indicate the following:
  6. The actual flow and temperature into Temperature Mixing Valve
  7. The actual flow and temperature back to the heaters and/or storage tanks

### 3.22 CLEANING

#### A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
3. Flush piping system with clean, potable water until dirty water does not appear at outlets.
4. Fill and isolate system according to either of the following:

- a. Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
  - b. Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
5. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  6. Repeat procedures if biological examination shows contamination.
  7. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
  3. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\221110\_COMMON PLUMBING PIPING.DOC



## SECTION 221119 - WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Vacuum breakers.
  - 2. Strainers.
  - 3. Drain valves.
  - 4. Specialty valves.
  - 5. Flexible connectors.
- B. All pipe, fittings, and valves used in this distribution system and installed after January 4, 2014 must comply with the new Federal Mandate known as the "Reduction of Lead in Drinking Water Act-2014". Any product pipe, fittings or valve installed after the enactment date that does not comply, shall be removed and changed by this contractor at Contractor expense to comply with the Federal Law

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - B. Shop Drawings: For domestic water piping specialties.
- 1. Include diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. All pipe, fittings, and valves used in this distribution system and installed after January 4, 2014 must comply with the new Federal Mandate known as the "Reduction of Lead in Drinking Water Act-2014". Therefore, after the enactment date of 1/4/14, all products installed must comply. Any product pipe, fittings, valve, or specialty item installed after the enactment date that does not comply, shall be removed and changed by this contractor at his/her own expense to comply with the Federal Law
- B. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Water Piping Specialties: 150 psig unless otherwise indicated.

### 2.3 VACUUM BREAKERS

#### A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Ames Co.
  - b. Cash Acme.
  - c. Conbraco Industries, Inc.
  - d. FEBCO.
  - e. Watts; a Watts Water Technologies company.
  - f. Zurn Industries, LLC.
- 2. Standard: ASSE 1001.
- 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
- 4. Body: Bronze.
- 5. Inlet and Outlet Connections: Threaded.
- 6. Finish: Rough bronze.
- 7. Basis of Design for Cold Water: Watts LF288A, Cash Acme V101.
- 8. Basis of Design for Hot Water: Cash Acme V101.

#### B. Hose-Connection Vacuum Breakers :

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Cash Acme.

- b. Conbraco Industries, Inc.
  - c. Watts; a Watts Water Technologies company.
  - d. Woodford Manufacturing Company.
  - e. Zurn Industries, LLC.
2. Standard: ASSE 1011.
  3. Body: Bronze, non-removable, with manual drain.
  4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  5. Finish: Chrome or nickel plated Rough bronze. Match finish of HB
  6. Basis of Design: Cash Acme VB-222.

**C. Pressure Vacuum Breakers:**

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Ames Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO.
  - d. Watts; a Watts Water Technologies company.
  - e. Zurn Industries, LLC.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:
  - a. Valves: Ball type, on inlet
6. Basis of Design Cold Water: Watts series LF800M4QT
7. Basis of Design Hot Water: Cash Acme PVB
8. Basis of Design Freeze Proof Cold Water: Watts series 800M4FR

**2.4 BACKFLOW PREVENTERS**

**A. Reduced-Pressure-Principle Backflow Preventers:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO.
  - c. Watts; a Watts Water Technologies company.
  - d. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 8 PSIG maximum, through middle third of flow range.
5. Body: Bronze for NPS 2 and smaller; steel with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged or mechanical for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
  - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
9. Basis of Design: Watts 909-QT-S
10. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Conbraco Industries, Inc.
  - b. Watts; a Watts Water Technologies company.
  - c. Woodford Manufacturing Company.
11. Standard: ASSE 1052.
12. Operation: Up to 10-foot head of water back pressure.
13. Inlet Size: NPS 1/2 or NPS 3/4.
14. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
15. Capacity: At least 3-gpm flow.

**B. Backflow-Preventer Test Kits :**

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO.
  - c. Watts; a Watts Water Technologies company.
  - d. Zurn Industries, LLC.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

**2.5 STRAINERS FOR WATER PIPING**

**A. Y-Pattern Strainers:**

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.10 inch
6. Drain: 1/2 to 2 inch pipe plug 2-1/2 inches and larger - Factory-installed, hose-end drain valve.

## 2.6 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Flexicraft Industries.
  2. Metraflex Company (The).
  3. Universal Metal Hose.
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  1. Working-Pressure Rating: Minimum 250 psig.
  2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  1. Working-Pressure Rating: Minimum 250 psig.
  2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
- B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.
  - E. Install Y-pattern strainers for water on supply side of each control valve water pressure-reducing valve solenoid valve and pump.
  - F. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Division 06.
  - G. Install water-hammer arresters in water piping according to PDI-WH 201.
  - H. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
  - I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
  - J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Division 26.
- B. Fire-retardant-treated-wood blocking is specified in Division 26 for electrical connections.

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  1. Pressure vacuum breakers.
  2. Intermediate atmospheric-vent backflow preventers.
  3. Reduced-pressure-principle backflow preventers.
  4. Water pressure-reducing valves.
  5. Calibrated balancing valves.
  6. Primary, thermostatic, water mixing valves.
  7. Manifold, thermostatic, water mixing-valve assemblies.
  8. Outlet boxes.
  9. Supply-type, trap-seal primer valves.
  10. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer Insert type according to authorities having jurisdiction and the device's reference standard.
  - B. Water piping specialties will be considered defective if they do not pass tests and inspections.
  - C. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\221119\_WATER PIPING SPECIALTIES.DOC

## SECTION 230500 - COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Certain requirements common to all the mechanical and electrical trades (Fire Suppression, Plumbing, HVAC, Electrical, and Tele/Data) are specified in Division 20, Common Mechanical and Electrical Requirements. To avoid repetition, they are not repeated in each relevant Section. These requirements are applicable to the work of this Division, and are hereby incorporated by reference.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Painting and finishing.
  - 10. Concrete bases.
  - 11. Supports and anchorages.
  - 12. Containment Room Sealing Requirements.
  - 13. Rated fire penetration sealants.
  - 14. Material and workmanship.
  - 15. Access panels.

#### 1.3 REFERENCES

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form part of this specification to the extent referenced. Publications are referenced in the text by the basic designations only.
  - 1. American Iron and Steel Institute (ASI)
  - 2. National Fire Protection Association (NFPA)
    - a. NFPA 70 National Electric Code
  - 3. American Society for Testing and Materials (ASTM)
    - a. ASTM A36 Standard Specification for Carbon Structural Steel
    - b. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless



- c. ASTM A109 Standard Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
  - d. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - e. ASTM A240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - f. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - g. ASTM A501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
  - h. ASTM A633 Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates
  - i. ASTM A635 Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Commercial Steel, Drawing Steel, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, Hot-Rolled
  - j. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - k. ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled
  - l. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
  - m. ASTM A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
  - n. ASTM A1018 Standard Specification for Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, Columbium or Vanadium, and High-Strength Low-Alloy with Improved Formability
  - o. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus
  - p. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
  - q. ASTM C920 Standard Specification for Elastomeric Joint Sealants
  - r. ASTM C1193 Standard Guide for Use of Joint Sealants
  - s. ASTM D522 Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
  - t. ASTM D523 Standard Test Method for Specular Gloss
  - u. ASTM D610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces.
  - v. ASTM D2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
  - w. ASTM D3451 Standard Guide for Testing Coating Powders and Powder Coatings
  - x. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
  - y. ASTM F1136 Standard Specification for Chromium/Zinc Corrosion Protective Coatings for Fasteners
- 4. American Welding Society (AWS)
  - 5. Code of Federal Regulations (CFR)
  - 6. Metal Framing Manufacturers Association (MFMA)
    - a. MFMA Metal Framing Standards Publication
  - 7. Underwriters Laboratories (UL)
    - a. UL 723 Test for Surface Burning Characteristics of Building Materials

#### 1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. CPVC: Chlorinated polyvinyl chloride plastic.
  - 2. PE: Polyethylene plastic.
  - 3. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.
  - 5. Containment room sealants.
  - 6. Rated fire penetration sealants.

- B. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
  - C. Align components. No strain shall be placed on weld during welding. No part of pipe shall be offset more than 20% of thickness. Set flanges and branches properly.
  - D. Weld only by approved acetylene or electric welding processes. All welders shall hold certificate from approved insurance company.
  - E. Conduct test to demonstrate suitability of procedures to be used in making welds that conform to specified requirements.
  - F. Welder Qualification:
    1. Test welders to demonstrate ability to make acceptable welds. Tests conducted for qualification of welder for work under one Division or Section shall not qualify welder for work under another Division or Section.
    2. Tests shall be as prescribed for welder qualification in Section IX of the ASME code.
    3. Records of tests shall be as follows: Each welder shall be assigned an identifying number, letter or symbol. Identifying mark shall be stamped adjacent to welds made by this welder. Identification shall be at top of horizontal piping and at front of vertical piping.
    4. Maintain record of welders employed, showing dates and results of tests and identifying mark assigned to each welder. Certify records and make them accessible to Owner's project representative and/or project manager. Before completion of project, one copy of records
    5. No qualification shall be older than three years when welder commences work on this project. If welder has not welded in required welding process for a period of six months, he shall be re-certified.
  - G. Welding Tests
    1. As designated by Architect, remove welds for destructive testing or for testing by non-destructive means. Tests shall be as determined by Architect.
    2. If, in Architect's opinion, welds so tested do not meet requirements of Sections VIII and IX of ASME, then the contractor shall pay for the costs of the tests. Remove welds welded by that welder, at no cost to the Owner. Rewelding shall be performed by qualified welder other than welder whose welds did not pass test. Welders whose welds were defective shall not be employed on site for remainder of project.
    3. Welding of stanchions, brackets, anchors and other welding not performed on pipe joints shall be in accordance with requirements of AWS specifications and requirements.
  - H. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
  - B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
  - C. Protect and cover equipment (VAV boxes, coils, fans, pumps, control valves, etc) and ductwork components with plastic when stored on site to prevent entrance of dirt, debris and moisture.

## 1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Proprietary Manufacturers: Provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  - 1. CPVC Piping: ASTM F 493.
  - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

#### 2.4 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Eslon Thermoplastics.
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Thompson Plastics, Inc.
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.

#### 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
  - a. Capitol Manufacturing Co.
  - b. Central Plastics Company.
  - c. Eclipse, Inc.
  - d. Epco Sales, Inc.
  - e. Hart Industries, International, Inc.
  - f. Watts Industries, Inc.; Water Products Div.
  - g. Zurn Industries, Inc.; Wilkins Div.
  
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
  1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
  
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Thunderline
  2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
  
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
  
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Perfection Corp.

- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Thunderline
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Plastic. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## 2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated

- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.9 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## 2.10 RATED FIRE PENETRATION SEALANTS

- A. Submit 3M, Hilti or Firespec sealants for approval prior to use.
- B. Sealants, caulking and devices shall be rated the same as the wall rating they are used in.

## 2.11 ACCESS PANELS

- A. Description: Interior construction access panels.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following or equivalent:
    - a. Milcor
    - b. Knapp
    - c. Nystorm
    - d. Inland Steel
- B. Coordinate selection with other Divisions supplying similar access panels.
- C. Access panels shall have same fire rating classification as surface penetrated.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.



- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes as specified in other Division 23 sections.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
  - 2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
  - 3. Insulated Piping: One-piece, stamped-steel type .
  - 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
  - 5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
  - 6. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type
  - 7. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
  - 8. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

### 3.2 PENETRATIONS AND SLEEVES

#### A. General

- 1. Lay out penetration and sleeve openings in advance, to permit provision in work. Coordinate work carefully with architectural and structural work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed. Remedial work includes core drilling (see requirements below) for penetrations if walls are poured, or otherwise constructed, without required sleeves. Provide core drilling (see requirements below) of existing construction. Do not penetrate structural members without Structural Engineer's/Architect's written approval.
- 2. Provide sleeves and packing materials at penetrations of foundations, walls, basement floors, slabs (except on-grade), partitions and floors. Sleeve installation shall meet NFPA-101 requirements, UL rated assemblies requirements, and materials requirements of these specifications. Submit a list of the UL listed details that the Contractor intends on using on this project in all rated assemblies.
- 3. Sleeves that penetrate outside walls, basement slabs, footings and beams shall be waterproof. Sleeves that penetrate floors shall be fireproof and waterproof.
- 4. Sleeves for insulated pipe and duct in non-fire rated construction shall accommodate continuous insulation without compression. Sleeves and/or penetrations in fire rated construction that do not require fire dampers shall be packed with fire rated material that shall maintain the fire rating of

- the wall. Seal ends of penetrations to provide continuous vapor barrier where insulation is interrupted. Where fire dampers are required, install sleeve and damper assembly in accordance with damper listing.
5. Where pipes passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.
  6. Identify unused sleeves and slots for future installation. Fill slots, sleeves and other openings in floors or walls if not used. Fill spaces in openings after installation of pipe, duct, conduit or cable. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes.
  7. Do not support piping risers or conduit on sleeves.
  8. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7, Through-Penetration Firestop Systems for materials.
  9. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.
  10. Installation Testing, Listings and Approvals
    - a. Installation of sleeves, fill and packing shall meet material manufacturer's recommendations exactly, particularly as regards safety, ventilation, removal of foreign materials and other details of installation. Dam openings as recommended. Remove flammable materials used for damming and forming seals in fire-rated construction.
    - b. Sleeve penetration methods shall be water- and gas-tight and shall meet requirements of ASTM E-119 Standard Methods of Fire Tests of Building Construction and Materials.
    - c. Fire-stop penetration seal methods and materials shall be FM-approved and UL-listed as applicable. They shall have the same rating as the structure penetrated. Submit manufacturer's detail sheet indicating assembly rating.
      - 1) Inspect foamed sealants to ensure manufacturer's optimum cell structure and color ranges.
- B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs. Sleeves are not required for slab-on-grade floors unless specified otherwise. Sleeves are required for core-drilled holes on any floor.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  3. Install sleeves that are large enough to provide 1/4 inch (6.4 mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07, Sheet Metal Flashing and Trim for flashing.
      - 1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07, Joint Sealants for materials and installation.
- C. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- D. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- E. Duct Sleeves and Prepared Openings
1. Provide galvanized-steel sheet duct sleeves for round ducts 15" and smaller. Provide prepared, framed openings for round ducts larger than 15" and for square, rectangular and flat oval ducts, except as specified otherwise. Sleeves shall meet SMACNA requirements.
  2. Provide galvanized-steel sheet duct sleeves for ducts through 1-, 2- or 3-hour fire-rated construction and smoke partitions, regardless of size and shape of ducts. Sleeves shall maintain fire rating of construction penetrated. Sleeve and seal materials, construction and clearances shall meet requirements of SMACNA Fire Damper and Heat Stop Guide for Air Handling Systems.
  3. Prepared openings shall be framed to provide 1" clearance between framing and duct or duct insulation.
  4. Provide 4 inches (100 mm) wide 20 gauge galvanized sheet metal collars at sleeves and prepared openings, sized to cover entire duct penetration including sleeve and seal, and to accommodate duct and insulation as necessary. Edges shall have milled lips ground smooth. Paint to match finish of duct or as directed by Architect.
  5. All duct penetrations through concrete floors in mechanical rooms shall be provided with 2 inches (50 mm) high water stopped curbs surrounding the openings. This applies to mechanical rooms located above the lowest floor level.
- F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07, Penetration Firestopping for materials.
- G. Verify final equipment locations for roughing-in.
- H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 CORE DRILLING

- A. Core drilling shall be avoided in new construction. Set sleeves prior to installation of structure for passage of pipes, conduit and ducts. Where core drilling is unavoidable (e.g. when individual sleeves are not installed or incorrectly located) or required by renovation projects, locate required openings prior to coring and submit locations for review.
- B. Coordinate openings with other Divisions.
- C. Do not disturb existing systems. Protect areas from damage.
- D. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.

- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.6 EXPANSION PROVISIONS

- A. Installation of piping must allow for expansion using offsets or loops, as necessary to prevent undue strain. Takeoffs from mains to runouts shall not have less than three-elbow swing.
- B. Mains and risers with loops or offsets shall be securely anchored to structure so as to impart expansion towards loops or offsets. Anchors shall be constructed of heavy forged wrought iron, secured to pipe and to structure. Provide vibration isolation as required.
- C. Provide pipe alignment guides as required to guide expanding pipe to move freely from anchor points toward expansion joints, offsets, etc.

### 3.7 ANCHORS AND INSERTS

- A. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.
- B. Provide anchors for attachment of equipment supports and hangers.

### 3.8 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to satisfaction of Architect and in accordance with code requirements.
- F. Distribute equipment loads on building structural members provided for equipment support. Roof-mounted equipment shall be installed and supported on structural steel.
- G. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall or ceiling mounting of equipment.
- H. Provide steel supports and hardware for proper installation of hangers, anchors and guides.
- I. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.
- J. Structural steel and hardware shall conform to Standard Specifications of ASTM; use of steel and hardware shall conform to requirements of Section Five of Code of Practice of American Institute of Steel Construction.
- K. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that shall void warrantee. Report in writing to Architect, prior to purchase or shipment of equipment involved, on conditions that may prevent proper installation.
- L. For all equipment installed external to the building; whether on roofs, supports, grade, etc., the installation shall comply with wind loading and impact requirements of the applicable codes for this project site. All equipment provided for this project shall be certified by the manufacturer that the equipment meets the applicable seismic, wind, earthquake, and hurricane impact requirements as set forth by the Authority Having Jurisdiction.

### 3.9 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09, Interior Painting and Exterior Painting.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Equipment installed shall have shop coat of non-lead gray paint. Hangers and supports shall have one coat of non-lead red primer. Machinery (e.g. pumps, fans and air handling units) shall be stenciled with equipment name. Stencil shall be at least 6" high for large equipment, 2 inches (50 mm) high for small equipment.
- D. Note requirement for Architect's approval invoked under paragraph MATERIALS AND WORKMANSHIP regarding finish of material and equipment that is visible or subject to corrosive or atmospheric conditions.

### 3.10 CONCRETE PADS

- A. Concrete Pads: Anchor equipment to concrete pad according to equipment manufacturer's written instructions and according to seismic codes at Project. Provide pads for pumps, tanks, heat exchangers, boilers, VFD's, BAS panels and other floor mounted equipment.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch (450 mm) centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000 psi (20.7 MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03, Cast-in-Place Concrete or Miscellaneous Cast-in-Place Concrete.

### 3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05, Metal Fabrications for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### 3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that shall not penetrate members if opposite side shall be exposed to view or shall receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.13 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that shall come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.

- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

### 3.14 ACCESS AND ACCESS PANELS

- A. Access panels are generally not shown on the drawings, but shall be provided.
- B. Provide proper access to materials and equipment that require inspection, replacement, repair or service, and coordinate their delivery with the installing Trade. If proper access cannot be provided, confer with Architect as to best method of approach for minimizing effect of reduced access that may result.
- C. Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to a representative of the installing Trade. Furnish and install distinctively colored buttons (color as selected by Architect) in finished ceiling to identify access panels
- D. Furnish access panels for installation under other Sections where fire dampers, smoke dampers, volume dampers, smoke detectors, controls, shut-off valves, control valves, check valves, or other items installed under this Section require access and are concealed in floor, wall, furred space or above ceiling.
- E. Ceilings consisting of lay-in or removable splined tiles do not require access panels and dampers, splitters, or test hole openings above ceiling shall have location marked with thumbtack on finished ceiling panel. Location shall be noted on record drawings.
- F. Access panels shall be at least large enough to remove the component requiring access. Where individual components (e.g. control valves) requiring access are within 8 inches (200 mm) of the finished surface, panels shall be a minimum of 12 inch by 12 inch (300 mm by 300 mm). Where component is more than 8 inches (200 mm) from surface and at equipment requiring service (e.g. VAV boxes, fan boxes, fire dampers), access panels shall be a minimum of 24 inch x 24 inch (600 mm x 600 mm).

### 3.15 MATERIALS AND WORKMANSHIP

- A. Work shall be neat and rectilinear. Ductwork, piping and conduit shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Install material and equipment in accordance with manufacturers written instructions. Installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion or water hammer. Work shall be properly and effectively protected, and pipe and duct openings shall be temporarily closed to prevent obstruction and damage before completion.
- B. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents.
- C. Owner shall not be responsible for material and equipment before testing, commissioning, and acceptance.

END OF SECTION 230500

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230500-COMMON WORK RESULTS FOR HVAC.DOC



## SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

## 2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. **Smith, Jay R. Mfg. Co.**
  - 2. **Zurn Specification Drainage Operation; Zurn Plumbing Products Group.**
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. **Underdeck Clamp: Clamping ring with setscrews.**

## 2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. **Advance Products & Systems, Inc.**
  - 2. **CALPICO, Inc.**
  - 3. **Metraflex Company (The).**
  - 4. **Pipeline Seal and Insulator, Inc.**
  - 5. **Proco Products, Inc.**
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. **Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.**
  - 2. **Pressure Plates: Galvanized steel.**
  - 3. **Connecting Bolts and Nuts: Galvanized steel of length required to secure pressure plates to sealing elements.**

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. **Presealed Systems.**
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## 2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that shall have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07, Joint Sealants.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07, Penetration Firestopping.

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07, Sheet Metal Flashing and Trim.
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07, Penetration Firestopping.

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
3. Interior Partitions:
  - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 230517

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230517-SLEEVES AND SLEEVE SEALS FOR HVAC PIPING.DOC

## SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

#### 2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Insulated Piping: One-piece, stamped-steel type.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

#### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230518-ESCTUCHEONS FOR HVAC PIPING.DOC

## SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Butterfly valves.
  - 3. High-performance butterfly valves.
  - 4. Bronze swing check valves.
  - 5. Iron gate valves.
  - 6. Bronze globe valves.
  - 7. Iron globe valves.
  - 8. Eccentric plug valves.
  - 9. Chainwheels.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.



#### 1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC schedule on drawings for applications of valves. Valves shall be of the same manufacturer as the rest of the building.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures. Valves shall have name of manufacturer and guaranteed working pressure cast or stamped on bodies. Gaskets and packings shall not contain asbestos.

- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
  - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
  - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
  - 1. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Stainless steel.
    - i. Ball: Stainless steel, vented.
    - j. Port: Full.
- B. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Three piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

## 2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

### A. 200 CWP, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Cameron
  - b. Velan
  - c. DeZurik AWWA.
2. Description:
  - a. Standard: MSS SP-67, Type I.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: ASTM A 536, ductile iron or carbon steel.
  - e. Seat: EPDM.
  - f. Stem: One- or two-piece 316 stainless steel.
  - g. Disc: stainless steel.
  - h. Gear operator above 5 inch.

## 2.4 HIGH-PERFORMANCE BUTTERFLY VALVES

### A. Class 300, Single-Flange, High-Performance Butterfly Valves:

1. Description:
  - a. Standard: MSS SP-68.

- b. CWP Rating: 720 psig at 100 deg F.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: Carbon steel.
- e. Seat: Reinforced PTFE .
- f. Stem: 17-4 Stainless steel; offset from seat plane.
- g. Disc: 316 stainless steel.
- h. Service: Bidirectional.

## 2.5 BRONZE SWING CHECK VALVES

### A. Class 125, Bronze Swing Check Valves with Bronze Disc:

#### 1. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

### B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

#### 1. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: TFE unless indicated otherwise in table.

### C. Class 150, Bronze Swing Check Valves with Bronze Disc:

#### 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Kitz Corporation.
- e. Milwaukee Valve Company.

- f. NIBCO INC.
- 2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 300 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.
- D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
  - 1. .Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 300 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: TFE unless indicated otherwise in table.

## 2.6 IRON SWING CHECK VALVES

- 1. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
  - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
  - d. Body Design: Clear or full waterway.
  - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - f. Ends: Flanged.
  - g. Trim: Bronze unless indicated otherwise in table.
  - h. Gasket: Asbestos free.
- B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
  - 1. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
    - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
    - d. Body Design: Clear or full waterway.

- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.
- g. Trim: Composition.
- h. Seat Ring: Bronze.
- i. Disc Holder: Bronze.
- j. Disc: TFE unless indicated otherwise in table.
- k. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.
- g. Trim: Bronze unless indicated otherwise in table.
- h. Gasket: Asbestos free.

2.7 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

B. Class 250, OS&Y, Iron Gate Valves:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.

- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

## 2.8 IRON GLOBE VALVES

### 1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

### B. Class 250, Iron Globe Valves:

#### 1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

## 2.9 ECCENTRIC PLUG VALVES

### A. 175 CWP, Eccentric Plug Valves with Resilient Seating.

#### 1. Description:

- a. Standard: MSS SP-108.
- b. CWP Rating: 175 psig minimum.
- c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
- d. Bearings: Oil-impregnated bronze or stainless steel.
- e. Ends: Flanged.
- f. Stem-Seal Packing: Asbestos free.

- g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

## 2.10 CHAINWHEELS

- A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
  - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
  - 2. Attachment: For connection to ball, butterfly, gate valve stems.
  - 3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Provide zinc coating.
  - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball, butterfly, gate and globe valves NPS 3 and larger and more than 78 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:



1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. Valves on steam, steam condensate, chilled water, hot water and glycol services shall be as shown on drawings. If valve applications are not indicated, use the following:
  1. Shutoff Service: Ball, butterfly, or gate valves.
  2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  3. Throttling Service except Steam: Ball, or butterfly valves.
  4. Throttling Service, Steam: Globe valves.
  5. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: spring wafer check valve with bronze disc. .
    - b. NPS 2-1/2 and Larger: iron, center-guided, metal -seat check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  1. For Copper Tubing, NPS 2 and Smaller: Threaded ends. .
  2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends. .
  4. For Steel Piping, NPS 5 and Larger: Flanged ends.

END OF SECTION 230523

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230523-GENERAL DUTY VALVES.DOC

## SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.
- B. Related Sections include the following:
  - 1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Pipe stands. Include Product Data for components.
  - 4. Equipment supports.
- C. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." and AWS D1.3, "Structural Welding Code--Sheet Steel."
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Carpenter & Paterson, Inc.
  - 3. Empire Industries, Inc.
  - 4. ERICO/Michigan Hanger Co.
  - 5. Globe Pipe Hanger Products, Inc.
  - 6. Grinnell Corp.
  - 7. National Pipe Hanger Corporation.
  - 8. PHD Manufacturing, Inc.
  - 9. PHS Industries, Inc.
  - 10. Piping Technology & Products, Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. GS Metals Corp.
  - 4. Power-Strut Div.; Tyco International, Ltd.
  - 5. Thomas & Betts Corporation.
  - 6. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield. Insert shall be capable of supporting weight of pipe, insulations and fluid without crushing.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO/Michigan Hanger Co.
  - 3. PHS Industries, Inc.
  - 4. Pipe Shields, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

## 2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ERICO/Michigan Hanger Co.
    - b. MIRO Industries.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. MIRO Industries.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ERICO/Michigan Hanger Co.
    - b. MIRO Industries.
    - c. Portable Pipe Hangers.
  - 2. Base: Stainless steel.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Portable Pipe Hangers.
  - 2. Bases: One or more plastic.
  - 3. Vertical Members: Two or more protective-coated-steel channels.
  - 4. Horizontal Member: Protective-coated-steel channel.
  - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

## 2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in other Division 23 Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that shall not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  7. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  9. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  10. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
  11. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  12. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  13. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  14. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  15. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  16. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:



1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89, or standards in Tables 1 and 2, whichever is stricter. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- F. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement shall not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
  6. Insert Material: Length at least as long as protective shield.
  7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230529-HANGERS AND SUPPORTS.DOC

## SECTION 230548 - VIBRATION CONTROLS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Certain requirements common to all the mechanical and electrical trades (Fire Suppression, Plumbing, HVAC, Electrical, and Tele/Data) are specified in Division 20. To avoid repetition, they are not repeated in each relevant Section. These requirements are applicable to the work of this Division, and are hereby incorporated by reference.

#### 1.2 SUMMARY

- A. Section Includes
  - 1. Vibration Isolation Devices:
    - a. Spring hangers (suspended AC unit).

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
  - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
  - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:

1. Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

### PART 2 - PRODUCTS

#### 2.1 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. **Ace Mountings Co., Inc.**
    - b. **California Dynamics Corporation.**
    - c. **Kinetics Noise Control, Inc.**
    - d. **Mason Industries, Inc.**
    - e. **Vibration Eliminator Co., Inc.**
    - f. **Vibration Isolation.**
    - g. **Vibration Mountings & Controls, Inc.**
  2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 VIBRATION CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
  1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
  2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.



### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 230548

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230548-VIBRATION CONTROLS FOR HVAC.DOC

## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.
  - 5. Stencils.
  - 6. Valve tags.
  - 7. Warning tags.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

#### A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

#### D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Label Content: Include caution and warning information, plus emergency notification instructions.

### 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 incheshigh.

### 2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 incheshigh.

## 2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Brass.
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Comply with ANSI/ASME A13.1.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. At each tee or change in direction.
  - 7. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 8. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
  - 1. Chilled-Water Piping:
    - a. Background Color: Green.
    - b. Letter Color: White.
  - 2. Heating Water Piping:
    - a. Background Color: Green.
    - b. Letter Color: White.
  - 3. Refrigerant Piping:
    - a. Background Color: Gray.
    - b. Letter Color: White.

4. Low-Pressure Steam Piping:
  - a. Background Color: Gray.
  - b. Letter Color: White.
5. Steam Condensate Piping:
  - a. Background Color: Green.
  - b. Letter Color: White.

### 3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
  1. Blue: For cold-air supply ducts.
  2. Yellow: For hot-air supply ducts.
  3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
  4. ASME A13.1 Colors and Designs: For hazardous material exhaust (fume hoods and snorkels).
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  1. Valve-Tag Size and Shape:
    - a. Chilled Water: 2 inches, round.
    - b. Refrigerant: 2 inches, round.
    - c. Hot Water: 2 inches, round.
    - d. Low-Pressure Steam: 2 inches, round.
    - e. Steam Condensate: 2 inches, round.
  2. Valve-Tag Color:
    - a. Chilled Water: Green.

- b. Refrigerant: Natural.
  - c. Hot Water: Green.
  - d. Low-Pressure Steam: Natural.
  - e. Steam Condensate: Natural.
3. Letter Color:
- a. Chilled Water: Black.
  - b. Refrigerant: Black.
  - c. Hot Water: Black.
  - d. Low-Pressure Steam: Black.
  - e. Steam Condensate: Black.

### 3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230553-IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.DOC



## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Variable-air-volume systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Variable-flow hydronic systems.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

### 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB TABB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. TAB Conference: Meet with Owner and Construction Manager on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Construction Manager and Engineer.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide ten working days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.

- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23, Air Duct Accessories.
  3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23, Duct Insulation, Division 23, HVAC Equipment Insulation, and Division 23, HVAC Piping Insulation.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in English units.

#### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.
- H. Check condensate drains for proper connections and functioning.
- I. Check for proper sealing of air-handling-unit components.
- J. Verify that air duct system is sealed as specified in Division 23, Metal Ducts.

#### 3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
  1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
  - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
  - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

### 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  1. Open all manual valves for maximum flow.
  2. Check liquid level in expansion tank.
  3. Check makeup water-station pressure gage for adequate pressure for highest vent.
  4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
  5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  6. Set system controls so automatic valves are wide open to heat exchangers.
  7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.7 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- B. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- C. Set calibrated balancing valves, if installed, at calculated presettings.
- D. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  1. Determine the balancing station with the highest percentage over indicated flow.
  2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  3. Record settings and mark balancing devices.
- G. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

### 3.8 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

### 3.9 PROCEDURES FOR STEAM SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.
- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

### 3.10 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### 3.11 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
1. Entering- and leaving-water temperature.
  2. Water flow rate.
  3. Water pressure drop.
  4. Dry-bulb temperature of entering and leaving air.
  5. Wet-bulb temperature of entering and leaving air for cooling coils.
  6. Airflow.
  7. Air pressure drop.
- B. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
  2. Wet-bulb temperature of entering and leaving air.
  3. Airflow.
  4. Air pressure drop.
  5. Refrigerant suction pressure and temperature.

### 3.12 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
  2. Air Outlets and Inlets: Plus or minus 5 percent.



3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

### 3.13 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.14 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  1. Fan curves.
  2. Manufacturers' test data.
  3. Field test reports prepared by system and equipment installers.
  4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  1. Title page.
  2. Name and address of the TAB contractor.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans performance forms including the following:
    - a. Conditions of filters.
    - b. Cooling coil, wet- and dry-bulb conditions.
    - c. Fan drive settings including settings and percentage of maximum pitch diameter.
    - d. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. AC-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - j. Number, make, and size of belts.

- k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):
    - a. Total air flow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static-pressure differential in inches wg.
    - f. Preheat-coil static-pressure differential in inches wg.
    - g. Cooling-coil static-pressure differential in inches wg.
    - h. Heating-coil static-pressure differential in inches wg.
    - i. Outdoor airflow in cfm.
    - j. Return airflow in cfm.
    - k. Outdoor-air damper position.
    - l. Return-air damper position.
    - m. Vortex damper position.
- F. Apparatus-Coil Test Reports:
  1. Coil Data:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in fins per inch o.c.
    - f. Make and model number.
    - g. Face area in sq. ft..
    - h. Tube size in NPS.
    - i. Tube and fin materials.
    - j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
  - a. Air flow rate in cfm.
  - b. Average face velocity in fpm.
  - c. Air pressure drop in inches wg.
  - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
  - e. Return-air, wet- and dry-bulb temperatures in deg F.
  - f. Entering-air, wet- and dry-bulb temperatures in deg F.
  - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
  - h. Water flow rate in gpm.
  - i. Water pressure differential in feet of head or psig.
  - j. Entering-water temperature in deg F.
  - k. Leaving-water temperature in deg F.
  - l. Refrigerant expansion valve and refrigerant types.
  - m. Refrigerant suction pressure in psig.
  - n. Refrigerant suction temperature in deg F.
  - o. Inlet steam pressure in psig.
  
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
  1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.
  
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated air flow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual air flow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
  
- I. Air-Terminal-Device Reports:
  1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft..
  
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Air velocity in fpm.

- c. Preliminary air flow rate as needed in cfm.
  - d. Preliminary velocity as needed in fpm.
  - e. Final air flow rate in cfm.
  - f. Final velocity in fpm.
  - g. Space temperature in deg F.
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.
- K. Instrument Calibration Reports:
- 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### 3.15 INSPECTIONS

- A. Initial Inspection:
- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
  - 2. Check the following for each system:

- a. Measure airflow of at least 10 percent of air outlets.
- b. Measure water flow of at least 5 percent of terminals.
- c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
- d. Verify that balancing devices are marked with final balance position.
- e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Commissioning Authority.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
3. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work shall be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230593\_TESTING, ADJUSTING, AND BALANCING FOR HVAC.DOC

## SECTION 230713 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply.
  - 2. Indoor, exposed supply.
  - 3. Indoor, exhaust utilized for energy recovery.
  - 4. Indoor, exhaust between isolation damper and penetration of building exterior.
  - 5. Outdoor, exposed supply and exhaust.
  - 6. Outside air intake ductwork.
  - 7. Boiler combustion air ducts.
- B. Lined ductwork is not permitted.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
  - 1. Sheet Form Insulation Materials: 12 inches square.
  - 2. Sheet Jacket Materials: 12 inches square.



3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23, Hangers and Supports for HVAC Piping and Equipment.
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Fiberglass Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, with factory-applied ASJ jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.
- F. Fiberglass Board Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.
    - d. Knauf Insulation; Insulation Board.

- e. Manson Insulation Inc.; AK Board.
- f. Owens Corning; Fiberglas 700 Series.

G. Fiberglass, Preformed Semi-rigid Insulation

1. Type I, 850 deg F (454 deg C) Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ complying with ASTM C1393.
2. Available Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Johns Manville; a Berkshire Hathaway company.
  - b. Knauf Insulation.
  - c. Manson Insulation Inc.
  - d. Owens Corning.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Aeroflex USA, Inc.; Aero seal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Fiberglass Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-03/11-70.Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-03/11-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
  - b. Eagle Bridges - Marathon Industries; 501.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
  - d. Mon-Eco Industries, Inc.; 55-10.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F.
  4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-03/11-96.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F.
  4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  5. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - b. Vimasco Corporation; 713 and 714.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  4. Service Temperature Range: 0 to plus 180 deg F.

5. Color: White.

## 2.5 SEALANTS

### A. FSK and Metal Jacket Flashing Sealants:

1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
  - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - c. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
- D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white stucco-embossed aluminum-foil facing.
1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Polyguard Products, Inc.; Alumaguard 60.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.



- c. [Compac Corporation](#); 120.
  - d. [Venture Tape](#); 3520 CW.
2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.9 SECUREMENTS

### A. Bands:

1. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. [ITW Insulation Systems](#); Gerrard Strapping and Seals.
  - b. [RPR Products, Inc.](#); Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - a. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - 1) [AGM Industries, Inc.](#); CWP-1.
    - 2) [GEMCO](#); CD.
    - 3) [Midwest Fasteners, Inc.](#); CD.
    - 4) [Nelson Stud Welding](#); TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - 1) [AGM Industries, Inc.](#); CHP-1.

- 2) [GEMCO](#); Cupped Head Weld Pin.
  - 3) [Midwest Fasteners, Inc.](#); Cupped Head.
  - 4) [Nelson Stud Welding](#); CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - 1) [AGM Industries, Inc.](#); Tactoo Perforated Base Insul-Hangers.
    - 2) [GEMCO](#); Perforated Base.
    - 3) [Midwest Fasteners, Inc.](#); Spindle.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - 1) [AGM Industries, Inc.](#); Tactoo Self-Adhering Insul-Hangers.
    - 2) [GEMCO](#); Peel & Press.
    - 3) [Midwest Fasteners, Inc.](#); Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. **Products:** Subject to compliance with requirements, provide products by one of the following or equivalent:
    - 1) [AGM Industries, Inc.](#); RC-150.
    - 2) [GEMCO](#); R-150.
    - 3) [Midwest Fasteners, Inc.](#); WA-150.

- 4) Nelson Stud Welding; Speed Clips.
- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. C & F Wire.

## 2.10 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that shall adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Division 07, Penetration Firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07, Penetration Firestopping.

### 3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.6 INSTALLATION OF FIBERGLASS INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 FINISHES

- A. Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09, Exterior Painting and Division 09, Interior Painting.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications shall be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
1. Indoor, concealed supply.



2. Indoor, exposed supply.
3. Indoor, exhaust utilized for energy recovery.
4. Indoor, exhaust between isolation damper and penetration of building exterior, and in shops and MEP areas.
5. Outdoor, exposed supply and exhaust.
6. Outside air intake ductwork.
7. Boiler combustion air ducts.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:

1. Fiberglass: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, exhaust-air duct insulation shall be one of the following:

1. Fiberglass: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

C. Concealed, rectangular, supply-air duct insulation shall be one of the following:

1. Fiberglass: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
2. Fiberglass Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

D. Rectangular, exhaust-air duct utilized for energy recovery shall be one of the following:

1. Fiberglass: 1-1/2 inches thick and 3-lb/cu. ft. nominal density (for concealed).
2. Fiberglass Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density (for exposed).

E. Exposed, round and flat-oval, supply-air duct insulation shall be the following:

1. Fiberglass Semi-rigid: 2 inches thick and 1.5-lb/cu. ft. nominal density.

F. Exposed, round and flat-oval, exhaust-air duct insulation shall be the following:

1. Fiberglass Semi-rigid: 2 inches thick and 1.5-lb/cu. ft. nominal density.

G. Exposed, rectangular, supply-air duct insulation shall be the following:

1. Fiberglass Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

- H. Rectangular, exhaust-air duct insulation shall be the following:
  - 1. Fiberglass: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. nominal density (for concealed).
  - 2. Fiberglass Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density (for exposed).
- I. Outdoor Air Intake Ductwork to be Fiberglass Board: 2 inches thick and 3-lb/cu. Foot nominal density.
- J. Boiler Combustion Air Ducts:
  - 1. Fiberglass Preformed Semi-rigid: 1-1/2 inches thick and 3 lb/cubic foot nominal density

### 3.12 OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Exposed, rectangular, supply-air duct insulation shall be the following:
  - 1. Fiberglass Board: 2 inches thick and 3-lb/cu. ft. nominal density.
- C. Exposed, rectangular, exhaust and return-air duct insulation shall be the following:
  - 1. Fiberglass Board: 2 inches thick and 3-lb/cu. ft. nominal density.
- D. Exposed, supply-air plenum insulation shall be the following:
  - 1. Fiberglass Board: 2 inches thick and 3-lb/cu. ft. nominal density.
- E. Exposed, return and exhaust-air plenum insulation shall be the following:
  - 1. Fiberglass Board: 2 inches thick and 3-lb/cu. ft. nominal density.

### 3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums in exposed finished spaces:
  - 1. Painted Aluminum, Smooth: 0.020 inch thick.
- D. Ducts and plenums in Mechanical Rooms and Penthouses less than 10 feet above finished floor.
  - 1. Aluminum, smooth, 0.020 inches thick.

### 3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
  - 1. Aluminum, Stucco Embossed: 0.024 inch thick.
- D. Ducts and Plenums, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
  - 1. Aluminum, Stucco Embossed with 1-1/4-Inch- Deep Corrugations: 0.032 inch thick.

END OF SECTION 230713

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230713\_DUCT INSULATION.DOC

## SECTION 230719 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping,
2. Chilled-water piping.
3. Heating hot-water piping.
4. Steam and steam condensate piping.
5. Heat-recovery/pre-heat piping.
6. Steam vents.

- B. Related Sections:

1. Division 33 for loose-fill pipe insulation in underground piping outside the building.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  2. Detail attachment and covering of heat tracing inside insulation.
  3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  4. Detail removable insulation at piping specialties.
  5. Detail application of field-applied jackets.
  6. Detail application at linkages of control devices.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23, Hangers and Supports for HVAC Piping and Equipment.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells, with factory applied ASJ.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Pittsburgh Corning Corporation; Foamglas.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.
  - 4. Board Insulation: ASTM C 552, Type IV.
  - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- H. Fiberglass Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290 with factory applied ASJ.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.
- I. Fiberglass Semi-rigid, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.

- e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F (454 deg C) Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Fiberglass and Mineral Fiber Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
  1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
    2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
  - C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
    1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
      - a. Aeroflex USA, Inc.; Aero seal.
      - b. Armacell LLC; Armaflex 520 Adhesive.
      - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
      - d. K-Flex USA; R-373 Contact Adhesive.
    2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
  - D. Fiberglass and Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
    1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
      - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
      - b. Eagle Bridges - Marathon Industries; 225.
      - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
      - d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.

### 2.4 SEALANTS

- A. Joint Sealants:



1. Joint Sealants for Cellular-Glass: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
  5. Color: White or gray.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    - d. Mon-Eco Industries, Inc.; 44-05.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  5. Color: Aluminum.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  5. Color: White.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
  1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
    - d. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 3) Tee covers.
      - 4) Flange and union covers.
      - 5) End caps.
      - 6) Beveled collars.
      - 7) Valve covers.
      - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches (75 mm).
  3. Thickness: 11.5 mils (0.29 mm).
  4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
  2. Width: 2 inches (50 mm).
  3. Thickness: 3.7 mils (0.093 mm).
  4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

## 2.8 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
  2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
  3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

- C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. C & F Wire.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that shall adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistant joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of

- valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF FIBERGLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- #### A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- #### B. Insulation Installation on Pipe Flanges:



1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.9 FINISHES

A. Pipe Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

- D. Do not field paint aluminum or stainless-steel jackets.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications shall be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
    - b. Fiberglass Semi-rigid, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- B. Chilled Water, above 40 Deg F (5 Deg C):
  - 1. NPS 2 and Smaller: Insulation shall be the following:
    - a. Fiberglass Semi-rigid, Preformed Piping: 1-1/2 inches (38 mm) thick.
  - 2. NPS 2-1/2" and Larger: Insulation shall be the following:
    - a. Fiberglass Semi-rigid, Preformed Piping: 1-1/2 inches (38 mm) thick.
- C. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and Below:

1. NPS 2 and Smaller: Insulation shall be the following:
    - a. Fiberglass Semi-rigid, Preformed Piping, Type I: 1-1/2 inches thick.
  2. NPS 2-1/2 and Larger: Insulation shall be the following:
    - a. Fiberglass Semi-rigid, Preformed Piping: 2 inches (50 mm) thick.
- D. Steam and Steam Condensate, below 260 Deg F:
1. NPS 2 and Smaller: Insulation shall be the following:
    - a. Fiberglass Semi-rigid, Preformed Pipe, Type I or II: 1-1/2 inches (38 mm) thick.
  2. NPS 2-1/2 and Larger: Insulation shall be the following:
    - a. Fiberglass Semi-rigid, Preformed Pipe: 3 inches (75 mm) thick.
- E. Heat-Recovery/Pre-heat Piping:
1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber: 1-1/2 inch thick.
- F. Steam Vents
1. Fiberglass semi-rigid Preformed Pipe: 1 inch thick.
- 3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
  - B. If more than one material is listed, selection from materials listed is Contractor's option.
  - C. Piping, Concealed:
    1. None, provide factory applied jacket.
  - D. Piping, Exposed in Mechanical Room:
    1. Provide with metal aluminum jacket where less than 10 feet above floor.
  - E. Piping, exposed in finished spaces:
    1. Metal aluminum jacket.

END OF SECTION 230719

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230719\_HVAC PIPING INSULATION.DOC

## SECTION 230800 - MECHANICAL SYSTEMS COMMISSIONING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The systems to be commissioned include all mechanical systems.
- C. Commissioning requires the participation of Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 019113. Division 23 shall be familiar with all parts of Section 019113 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

#### 1.2 RESPONSIBILITIES

- A. Mechanical, Controls and TAB Contractors: The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23 are as follows (all references apply to commissioned equipment only):
- B. Construction and Acceptance Phases
  - 1. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.
  - 2. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.
  - 3. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
    - a. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
    - b. The Commissioning Agent may request further documentation necessary for the commissioning process.
    - c. This data request may be made prior to normal submittals.
  - 4. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
  - 5. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
  - 6. Provide limited assistance to the CA in preparing the specific functional performance test procedures.
  - 7. During the startup and initial checkout process, execute the mechanical-related portions of the prefunctional checklists for all commissioned equipment.
  - 8. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.

9. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
  10. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
  11. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified equipment in Section 019113. Assist the CA in interpreting the monitoring data, as necessary.
  12. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, CM and A/E and retest the equipment.
  13. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
  14. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).
  15. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
  16. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
- C. **Warranty Period**
1. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
  2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
- D. **Mechanical Contractor:** The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. Provide startup for all HVAC equipment, except for the building automation control system.
  2. Assist and cooperate with the TAB contractor and CA by:
    - a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
    - b. Including cost of sheaves and belts that may be required by TAB
    - c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug
    - d. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing
  3. Install a P/T plug at each water sensor which is an input point to the control system.
  4. Notify the CM or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the CM or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.
  5. Prior to functional testing by the CA, provide the completed pre-functional checklists and manufacturer startup reports to the CA for review.
- E. **Controls Contractor.** The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. **Sequences of Operation Submittals:** The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications.
  2. **Control Drawings Submittal**
    - a. The control drawings shall have a key to all abbreviations.
    - b. The control drawings shall contain graphic schematic depictions of the systems and each component.

- c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
    - d. The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.
  3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
  4. Assist and cooperate with the TAB contractor in the following manner:
    - a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
    - b. For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.
    - c. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.
  5. Assist and cooperate with the CA in the following manner:
    - a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system as specified. Provide two-way radios during the testing.
    - b. Execute all control system trend logs as required by the CA.
  6. Provide a signed and dated certification to the CA and CM upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.
  7. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).
- F. TAB Contractor. The duties of the TAB contractor, in addition to those listed in (A) are:
  1. Submit the outline of the TAB plan and approach for each system and component to the CA, CM and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.
  2. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.
  3. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.
  4. Provide the CA with any requested data, gathered, but not shown on the draft reports.
  5. Provide a final TAB report for the CA with details, as in the draft.

### 1.3 RELATED WORK

- A. Refer to Section 019113, Part 1.1 for a listing of all sections where commissioning requirements are found.
- B. Refer to Section 019113 Part 1.11 for systems to be commissioned and section 019113 Part 1.8 for functional testing requirements.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Division 23 shall provide all test equipment necessary to fulfill the testing requirements of this Division.
- B. Refer to Section 019113 for additional Division 23 requirements.

## PART 3 - EXECUTION

### 3.1 SUBMITTALS

- A. Division 23 shall provide submittal documentation relative to commissioning as required in Section 019113.

### 3.2 STARTUP

- A. The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 019113. Division 23 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.
- B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and CM. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

### 3.3 TAB

- A. Refer to the TAB responsibilities in Part 1.11 above.

### 3.4 FUNCTIONAL PERFORMANCE TESTS

- A. Refer to Section 019113 Part 1.08 for a list of systems to be commissioned.

### 3.5 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

- A. Refer to Section 019113 for specific details on non-conformance issues relating to prefunctional checklists and tests.
- B. Refer to Section 019113 for issues relating to functional performance tests.

### 3.6 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.
- B. The CA shall receive a copy of the O&M manuals for review.
- C. Special Control System O&M Manual Requirements: In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.
  - 1. Three copies of the controls training manuals in a separate manual from the O&M manuals
  - 2. Operation and Maintenance Manuals containing:
    - a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.
    - b. Full as-built set of control drawings (refer to Submittal section above for details).
    - c. Full as-built sequence of operations for each piece of equipment
    - d. Full points list: In addition to the updated points list required in the original submittals (Part 1 of this section)
    - e. Full print out of all schedules and set points after testing and acceptance of the system
    - f. Full as-built print out of software program
    - g. Electronic copy on disk of the entire program for this facility
    - h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations
    - i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
    - j. Control equipment component submittals, parts lists, etc.
    - k. Warranty requirements
    - l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests)
  - 3. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.
- D. Special TAB Documentation Requirements: The TAB will compile and submit the following with other documentation that may be specified elsewhere in the *Specifications*.
  - 1. Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings
  - 2. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report

### 3.7 TRAINING OF OWNER PERSONNEL

- A. The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.
- B. The CA shall be responsible for verifying the training of Owner personnel for commissioned equipment. Refer to Section 019113 for additional details.
- C. Mechanical Contractor: The mechanical contractor shall have the following training responsibilities:
  - 1. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection



- equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.
2. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
  3. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
  4. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
  5. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
  6. Training shall include:
    - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    - b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
    - c. Discussion of relevant health and safety issues and concerns
    - d. Discussion of warranties and guarantees
    - e. Common troubleshooting problems and solutions
    - f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
    - g. Discussion of any peculiarities of equipment installation or operation
    - h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate
  7. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
  8. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not *controlled* by the central control system.
  9. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

D. Controls Contractor. The controls contractor shall have the following training responsibilities:

1. Provide the CA with a training plan four weeks before the planned training according to the outline described in Section 019113, Part 3.9.
2. The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.
3. Training manuals: The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals *and* in all software displays. Manuals will be approved by the CA. Copies of audiovisuals shall be delivered to the Owner.
4. The trainings will be tailored to the needs and skill-level of the trainees.
5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.
6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

7. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

3.8 DEFERRED TESTING

- A. Refer to Section 019113 for requirements of deferred testing.

3.9 WRITTEN WORK PRODUCTS

- A. Written work products of Contractors will consist of the filled out prefunctional checklists.

END OF SECTION 230800

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230800 FL - MECHANICAL SYSTEMS  
COMMISSIONING.DOC

## SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, and electrical/plumbing systems as applicable, including control components for terminal heating and cooling units not supplied with factory-wired controls.

#### 1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. MS/TP: Master slave/token passing.
- D. PC: Personal computer.
- E. PID: Proportional plus integral plus derivative.
- F. RTD: Resistance temperature detector.

#### 1.4 SYSTEM PERFORMANCE

- A. Incorporate/integrate Café areas into existing BAS system, update graphic interface, etc. Comply with the following performance requirements:
  - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
  - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
  - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
  - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
  - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
  - 6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.

7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
  - a. Water Temperature: Plus or minus 1 deg F.
  - b. Water Flow: Plus or minus 5 percent of full scale.
  - c. Water Pressure: Plus or minus 2 percent of full scale.
  - d. Space Temperature: Plus or minus 1 deg F.
  - e. Ducted Air Temperature: Plus or minus 1 deg F.
  - f. Dew Point Temperature: Plus or minus 3 deg F.
  - g. Temperature Differential: Plus or minus 0.25 deg F.
  - h. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
  - i. Airflow (Terminal): Plus or minus 10 percent of full scale.
  - j. Air Pressure (Space): Plus or minus 0.01-inch wg.
  - k. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
  - l. Carbon Dioxide: Plus or minus 50 ppm.
  - m. Electrical: Plus or minus 5 percent of reading.

#### 1.5 SEQUENCE OF OPERATION

- A. Refer to Drawings.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
  2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
  3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. Schedule of dampers including size, leakage, and flow characteristics.
  7. Schedule of valves including flow characteristics.
  8. DDC System Hardware:
    - a. Wiring diagrams for control units with termination numbers.

- b. Schematic diagrams and floor plans for field sensors and control hardware.
      - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
    - 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
    - 10. Controlled Systems:
      - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
      - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
      - c. Written description of sequence of operation including schematic diagram.
      - d. Points list.
  - C. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.
  - D. Samples for Verification: For each color required, of each type of thermostat or sensor cover.
- 1.7 INFORMATIONAL SUBMITTALS
- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
  - B. Qualification Data: For Installer.
  - C. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
  - D. Field quality-control test reports.
- 1.8 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, Operation and Maintenance Data, include the following:
    - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
    - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
    - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
    - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
    - 5. Calibration records and list of set points.
  - B. Software and Firmware Operational Documentation: Include the following:
    - 1. Software operating and upgrade manuals.
    - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
    - 3. Device address list.
    - 4. Printout of software application and graphic screens.
    - 5. Software license required by and installed for DDC workstations and control systems.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replacement Materials: One replacement diaphragm or relay mechanism for each unique valve motor, controller, thermostat and positioning relay.
  - 2. Maintenance Materials: Two thermostat adjusting key(s).

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.12 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 26, Addressable-Fixture Lighting Controls and Division 26, Relay-Based Lighting Controls to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- D. Coordinate equipment with Division 26, Electrical Power Monitoring and Control to achieve compatibility of communication interfaces.
- E. Coordinate equipment with Division 26, Panelboards to achieve compatibility with starter coils and annunciation devices.
- F. Coordinate equipment with Division 26, Motor-Control Centers to achieve compatibility with motor starters and annunciation devices.
- G. Coordinate with the requirements of equipment sections under Division 23 (Air Terminal Units, AC Units, Chilled Beams, Radiant Panels and Induction Fans).

## PART 2 - PRODUCTS

### 2.1 EXPANSION OF EXISTING BAS SYSTEM

- A. Available Manufacturers: Provide products by:
  - 1. Automated Logic Corporation, Radius Systems LLC, Chaddsford, PA.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical equipment.

### 2.2 DDC EQUIPMENT

- A. Minimum configuration as follows:
  - 1. Operating System: Microsoft Windows 8-1 with high-speed Internet access.
    - a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
  - 2. Application Software:
    - a. I/O capability from operator station.
    - b. System security for each operator via software password and access levels.
    - c. Automatic system diagnostics; monitor system and report failures.
    - d. Database creation and support.
    - e. Automatic and manual database save and restore.
    - f. Dynamic color graphic displays with up to 10 screen displays at once.
    - g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    - h. Alarm processing, messages, and reactions.
    - i. Trend logs retrievable in spreadsheets and database programs.
    - j. Alarm and event processing.
    - k. Object and property status and control.
    - l. Automatic restart of field equipment on restoration of power.
    - m. Data collection, reports, and logs. Include standard reports for the following:
      - 1) Current values of all objects.
      - 2) Current alarm summary.
      - 3) Disabled objects.
      - 4) Alarm lockout objects.
      - 5) Logs.
    - n. Custom report development.
    - o. Utility and weather reports.
    - p. Workstation application editors for controllers and schedules.
    - q. Maintenance management.
  - 3. Custom Application Software:
    - a. English language oriented.
    - b. Full-screen character editor/programming environment.

- c. Allow development of independently executing program modules with debugging/simulation capability.
  - d. Support conditional statements.
  - e. Support floating-point arithmetic with mathematic functions.
  - f. Contains predefined time variables.
- B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
  2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
    - d. Software applications, scheduling, and alarm processing.
    - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
  3. Standard Application Programs:
    - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
    - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
    - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    - d. Remote communications.
    - e. Maintenance management.
    - f. Units of Measure: Inch-pound and SI (metric).
  4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
  5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
  3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.



4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting shall cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
  2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
  5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
  6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  7. Universal I/Os: Provide software selectable binary or analog outputs.
- E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 60 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
  2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
  2. Maximum response time of 10 nanoseconds.
  3. Minimum transverse-mode noise attenuation of 65 dB.
  4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

## 2.3 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform automatic system diagnostics; monitor system and report failures.
  3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
  4. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
  5. Enclosure: Dustproof rated for operation at 32 to 120 deg F.

6. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

#### 2.4 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 75 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
  1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

#### 2.5 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
  1. Provide products by one of the following or equivalent:
    - a. BEC Controls Corporation.
    - b. Ebtron, Inc.
    - c. Heat-Timer Corporation.
    - d. I.T.M. Instruments Inc.
    - e. MAMAC Systems, Inc.
    - f. RDF Corporation.
  2. Accuracy: Plus or minus 0.5 deg F at calibration point.
  3. Wire: Twisted, shielded-pair cable.
  4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
  6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of one half of the pipe diameter.
  7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
    - a. Set-Point Adjustment: Exposed.
    - b. Set-Point Indication: Exposed.
    - c. Thermometer: Exposed.
    - d. Orientation: Vertical.
    - e. Unoccupied to occupied override switch - exposed.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Provide products by one of the following or equivalent:
  - a. BEC Controls Corporation.
  - b. MAMAC Systems, Inc.
  - c. RDF Corporation.
2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 48 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of one half of the pipe diameter.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - a. Set-Point Adjustment: Exposed.
  - b. Set-Point Indication: Exposed.
  - c. Thermometer: Exposed.
  - d. Orientation: Vertical.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Concealed.
2. Set-Point Indication: Concealed.
3. Thermometer: Concealed.
4. Orientation: Vertical.

E. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.

## 2.6 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

## 2.7 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - 1. Comply with requirements in Division 23, Common Motor Requirements for HVAC Equipment.
  - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  - 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
  - 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
  - 1. Provide products by one of the following or equivalent:
    - a. Belimo Aircontrols (USA), Inc.
  - 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
  - 3. Dampers: Size for running torque calculated as follows:
    - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    - c. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    - d. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
  - 4. Coupling: V-bolt and V-shaped, toothed cradle.
  - 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
  - 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
  - 7. Power Requirements (Two-Position Spring Return): 120-V ac.
  - 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
  - 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
  - 10. Temperature Rating: Minus 22 to plus 122 deg F.
  - 11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.

12. Run Time: 30 seconds.
13. Inlet-Vane Operators: High pressure, with pilot positioners.

## 2.8 CONTROL VALVES

- A. Provide products by one of the following or equivalent:
1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
  2. Erie Controls.
  3. Hayward Industrial Products, Inc.
  4. Magnatrol Valve Corporation.
  5. Neles-Jamesbury.
  6. Parker Hannifin Corporation; Skinner Valve Division.
  7. Pneuline Controls.
  8. Sauter Controls Corporation.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 and Smaller: Class 250 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
  2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
  3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
  4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:
    - a. Two Position: Line size.
    - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
  5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
  6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of total system (pump) head for three way valves and 100 percent of pressure differential across valve.
- D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: Lug.
  2. Disc Type: Aluminum bronze.
  3. Sizing: 1-psig maximum pressure drop at design flow rate.

- E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
  - 1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
  - 2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
  - 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that power supply is available to control units.

#### 3.2 INSTALLATION

- A. Install software in control units. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequences of operation on drawings.
- C. Verify locations of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation. Install devices 48 inches above the floor.
  - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats.
- E. Install labels and nameplates to identify control components according to Division 23, Identification for HVAC Piping and Equipment.
- F. Install hydronic instrument wells, valves, and other accessories according to Division 23, Hydronic Piping.
- G. Install duct volume-control dampers according to Division 23, Metal Ducts and Division 23, Nonmetal Ducts.

#### 3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26, Raceways and Boxes for Electrical Systems.
- B. Install building wire and cable according to Division 26, Low-Voltage Electrical Power Conductors and Cables.
- C. Install signal and communication cable according to Division 27, Communications Horizontal Cabling.
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install exposed cable in raceway.

3. Install concealed cable in raceway.
  4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
  5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
  6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### 3.4 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
1. **Operational Test:** After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  2. Test and adjust controls and safeties.
  3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  6. Test each system for compliance with sequence of operation.
  7. Test software and hardware interlocks.
- C. **DDC Verification:**
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  2. Check instruments for proper location and accessibility.
  3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  4. Check instrument tubing for proper fittings, slope, material, and support.
  5. Check installation of air supply for each instrument.
  6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  8. Check temperature instruments and material and length of sensing elements.
  9. Check control valves. Verify that they are in correct direction.
  10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
  11. Check DDC system as follows:

- a. Verify that DDC controller power supply is from emergency power supply, if applicable.
  - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
  - c. Verify that spare I/O capacity has been provided.
  - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.5 ADJUSTING

#### A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.
  - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
  - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
  - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
  - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
  - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
  - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
  - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

- B. Adjust initial temperature and humidity set points.



- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01, Demonstration and Training.

### 3.7 COMMISSIONING

- A. Comply with the requirements for commissioning under Divisions 01, 22, 23 and 26.
- B. The BAS graphics system shall be complete and tested prior to functional testing by the CX Agent.

END OF SECTION 230900

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\230900-INSTRUMENTATION AND CONTROL FOR HVAC.DOC

## SECTION 232113 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Hot-water heating piping.
  - 2. Chilled-water and secondary chilled water piping.
  - 3. Energy recovery/pre-heat water piping.
  - 4. Makeup-water piping.
  - 5. Condensate-drain piping.
  - 6. Air-vent piping.
  - 7. Safety-valve-inlet and -outlet piping.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Plastic pipe and fittings with solvent cement.
  - 2. RTRP and RTRF with adhesive.
  - 3. Pressure-seal fittings.
  - 4. Chemical treatment.
- B. Delegated-Design Submittal:
  - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
  - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
  - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
  - 4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Other building services.
  - 3. Structural members.

- B. Qualification Data: For Installer.
- C. Welding certificates.
- D. Field quality-control reports.
- E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
  - 1. Hot-Water Heating Piping: 150 psig at 200 deg F (93 deg C).
  - 2. Chilled-Water and Secondary Chilled Water Piping: 150 psig at 200 deg F (93 deg C).
  - 3. Energy Recovery/Pre-heat Water Piping: 150 psig at 150 deg F (66 deg C).
  - 4. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
  - 5. Condensate-Drain Piping: 150 deg F (66 deg C).
  - 6. Air-Vent Piping: 200 deg F (93 deg C).
  - 7. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
- B. Wrought-Copper Unions: ASME B16.22.

## 2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.

## 2.4 PLASTIC PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 441/F 441M, with wall thickness as indicated in "Piping Applications" Article.
  - 1. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.

## 2.5 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAG-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. CPVC Piping: ASTM F 493.
    - a. CPVC solvent cement shall have a VOC content of 490 g/L or less.
    - b. Adhesive primer shall have a VOC content of 550 g/L or less.
    - c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.6 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Charlotte Pipe and Foundry Company.
    - b. IPEX Inc.
    - c. KBI (King Bros. Industries).
  - 2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

## 2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. A.Y. McDonald Mfg. Co.
    - b. Capitol Manufacturing Company.
    - c. Central Plastics Company.
    - d. Hart Industries International, Inc.
    - e. Jomar International, Ltd.
    - f. Matco-Norca.
    - g. Watts Regulator Co.
    - h. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.
  - 2. Description:
    - a. Standard: ASSE 1079.

- b. Pressure Rating: 150 psig (1035 kPa).
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Matco-Norca.
  - d. Watts Regulator Co.
  - e. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.
- 2. Description:
  - a. Standard: ASSE 1079.
  - b. Factory-fabricated, bolted, companion-flange assembly.
  - c. Pressure Rating: 150 psig (1035 kPa).
  - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
- 2. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: 150 psig (1035 kPa).
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Elster Perfection.
  - b. Grinnell Mechanical Products.
  - c. Matco-Norca.
  - d. Precision Plumbing Products, Inc.
- 2. Description:
  - a. Standard: IAPMO PS 66.
  - b. Electroplated steel nipple, complying with ASTM F 1545.
  - c. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).

- d. End Connections: Male threaded or grooved.
- e. Lining: Inert and noncorrosive, propylene.

## 2.8 BYPASS CHEMICAL FEEDER

- A. Description: Welded steel construction; 125-psig (860-kPa) working pressure; 5-gal. (19-L) capacity; with fill funnel and inlet, outlet, and drain valves.
  - 1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
  - 1. Type K, seamless hard copper tubing, wrought-copper fittings, and soldered joints (propress acceptable where accessible).
  - 2. Schedule 40, Grade B, ASTM A53/106; Class 150, malleable-iron fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints (victaulic joints acceptable where accessible).
- C. Chilled-water and secondary chilled water piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
  - 1. Type K, seamless hard copper tubing, wrought-copper fittings, and soldered joints (propress acceptable where accessible).
  - 2. Schedule 40, Grade B, ASTM A53/106; Class 150, malleable-iron fittings; and threaded joints.
- D. Chilled-water and secondary chilled water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints (victaulic joints acceptable where accessible).
- E. Energy Recovery/Pre-heatwater piping, aboveground, NPS 2 (DN 50) and smaller, shall be the following:
  - 1. Type K, seamless hard copper tubing, wrought-copper fittings, and soldered joints (propress acceptable where accessible).
  - 2. Schedule 40, Grade B, ASTM A53/106; Class 150, malleable-iron fittings; and threaded joints.
- F. Energy Recovery/Pre-heat water piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints (victaulic joints acceptable where accessible).

- G. Makeup-water piping installed aboveground shall be either of the following:
  - 1. Type K, seamless hard copper tubing, wrought-copper fittings, and soldered joints (propress acceptable where accessible).
  - 2. Schedule 40 CPVC plastic pipe and fittings, and solvent-welded joints.
- H. Condensate-Drain Piping: Type K, seamless hard copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 CPVC plastic pipe and fittings and solvent-welded joints.
- I. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
  - 2. Outlet: Type K (Type A), annealed-temper copper tubing with soldered or flared joints.
- J. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
- K. Underground pre-insulated chilled water piping shall be provided for a distance of 5 feet outside the building in accordance with Division 23 under the Site/Civil package.

### 3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.



- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, anchors, and pipe alignment guides.
- U. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

### 3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.
- E. Provide isolation valves for dielectric fittings.

### 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with Section 230529 for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
  4. Spring hangers to support vertical runs.
  5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- C. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- D. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- E. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.
- 3.5 PIPE JOINT CONSTRUCTION
- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

### 3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  - 6. Prepare written report of testing.
- C. Perform the following before operating the system:
  - 1. Open manual valves fully.
  - 2. Inspect pumps for proper rotation.
  - 3. Set makeup pressure-reducing valves for required system pressure.
  - 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  - 5. Set temperature controls so all coils are calling for full flow.
  - 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, and chillers, to specified values.
  - 7. Verify lubrication of motors and bearings.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\232113-HYDRONIC PIPING.DOC

## SECTION 233113 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round and flat-oval ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.
  - 6. Seismic-restraint devices (Fume hood/general exhaust system).

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", ASCE/SEI 7 and IBC 2009.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Adhesives.
  - 2. Sealants and gaskets.
  - 3. Seismic-restraint devices.
- B. Shop Drawings:
  - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 2. Factory- and shop-fabricated ducts and fittings.
  - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
  - 4. Elevation of top of ducts.

5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

## 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct shall be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
  - a. Lighting fixtures.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse joints in ducts larger than 8 inches in width or height: flanged.
- C. Longitudinal Seams: Pittsburgh lock or continuously welded in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than **8 Inches** in Diameter: TDF/TDC.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  1. Fabricate round ducts larger than **90 inches (2286 mm)** in diameter with butt-welded longitudinal seams.
  2. Fabricate flat-oval ducts larger than **72 inches (1830 mm)** in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  1. Galvanized Coating Designation: **G90 (Z275)**.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- D. Aluminum Sheets: Comply with **ASTM B 209 (ASTM B 209M)** Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, **1/4-inch (6-mm)** minimum diameter for lengths **36 inches (900 mm)** or less; **3/8-inch (10-mm)** minimum diameter for lengths longer than **36 inches (900 mm)**.

## 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:



1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches (76 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.

4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction

loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least **1-1/2 inches (38 mm)**.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23, Air Duct Accessories for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING (NON-WELDED SYSTEMS)

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Seal Class A.
- C. Maximum total duct leakage not including duct mounted accessories (air terminals, dampers, sound attenuators, access doors) shall not exceed 2% of maximum airflow or SMACNA Seal Class "A" requirements, whichever is stricter.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23, Air Duct Accessories.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  2. Test the following systems:
    - a. Supply Ducts with a Pressure Class of **2-Inch wg (500 Pa)** or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
    - b. Return Ducts with a Pressure Class of **2-Inch wg (500 Pa)** or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
    - c. Exhaust Ducts with a Pressure Class of **2-Inch wg (500 Pa)** or Higher: Test duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
  3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  4. Test for leaks before applying external insulation.
  5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
  2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system shall be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- 3.7 DUCT CLEANING
- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23, Air Duct Accessories for access panels and doors.
  2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

D. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.8 START UP

- A. Air Balance: Comply with requirements in Division 23, Testing, Adjusting, and Balancing for HVAC.

END OF SECTION 233113

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\233113-METAL DUCTS.DOC

## SECTION 233300 - AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Manual volume dampers.
2. Fire dampers.
3. Smoke dampers.
4. Combination fire and smoke dampers.
5. Flange connectors.
6. Duct silencers.
7. Turning vanes.
8. Remote damper operators.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.

- B. Related Requirements:

1. Division 28 for duct-mounted fire and smoke detectors.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
  - a. Special fittings.
  - b. Manual volume damper installations.
  - c. Control-damper installations.
  - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, installations, including sleeves; and duct-mounted access doors and remote damper operators.
  - e. Wiring Diagrams: For power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

### PART 2 - PRODUCTS

#### 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

#### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.



- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 MANUAL VOLUME DAMPERS

### A. Standard, Steel, Manual Volume Dampers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Air Balance Inc.; a division of Mestek, Inc.
  - b. American Warming and Ventilating; a division of Mestek, Inc.
  - c. Flexmaster U.S.A., Inc.
  - d. McGill AirFlow LLC.
  - e. Nailor Industries Inc.
  - f. Pottorff.
  - g. Ruskin Company.
  - h. Trox USA Inc.
  - i. Vent Products Company, Inc.
- 2. Standard leakage rating.
- 3. Suitable for horizontal or vertical applications.
- 4. Frames:
  - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel or 0.05-inch-thick stainless steel, based on duct material.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
  - a. Multiple or single blade. Multiple blade above 12 inch duct depth.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized or Stainless-steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel or Stainless steel.
- 7. Bearings:
  - a. Sealed end bearings screwed or riveted to duct.
  - b. Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.

### B. Standard, Aluminum, Manual Volume Dampers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Air Balance Inc.; a division of Mestek, Inc.
  - b. American Warming and Ventilating; a division of Mestek, Inc.
  - c. McGill AirFlow LLC.
  - d. Nailor Industries Inc.

- e. Pottorff.
  - f. Ruskin Company.
  - g. Trox USA Inc.
  - h. Vent Products Company, Inc.
2. Standard leakage rating.
  3. Suitable for horizontal or vertical applications.
  4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade. Multiple blade above 12 inch duct depth.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
    - e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
  6. Blade Axles: Stainless steel.
  7. Bearings:
    - a. Sealed end bearings screwed or riveted to duct.
    - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Tie Bars and Brackets: Aluminum.

## 2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  1. Air Balance Inc.; a division of Mestek, Inc.
  2. Arrow United Industries; a division of Mestek, Inc.
  3. Greenheck Fan Corporation.
  4. Nailor Industries Inc.
  5. Prefco; Perfect Air Control, Inc.
  6. Ruskin Company.
  7. Vent Products Company, Inc.
  8. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream or Multiple-blade type; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

## 2.5 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  1. Air Balance Inc.; a division of Mestek, Inc.
  2. Cesco Products; a division of Mestek, Inc.
  3. Greenheck Fan Corporation.
  4. Nailor Industries Inc.
  5. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with mechanically attached corners and mounting flange.
- E. Blades: Roll-formed, horizontal, interlocking, thick, galvanized sheet steel.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.
- I. Damper Motors: two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23, Common Motor Requirements for HVAC Equipment.
  1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load shall not require motor to operate in service factor range above 1.0.
  2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23, Instrumentation and Control for HVAC.
  3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  4. Spring-Return Motors: Equip with an integral spiral-spring mechanism. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.

5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Auxiliary switch for position indication.
2. Momentary test switch, damper mounted.

2.6 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

G. Smoke Detector: Integral, factory wired for single-point connection.

H. Blades: Roll-formed, horizontal, interlocking, thick, galvanized sheet steel.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.

L. Damper Motors: two-position action.

M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23, Common Motor Requirements for HVAC Equipment.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load shall not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23, instrumentation and Control for HVAC.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.

4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Electrical Connection: 115 V, single phase, 60 Hz.

N. Accessories:

1. Auxiliary switch for position indication.
2. Momentary test switch, damper mounted.

## 2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

## 2.8 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

1. Industrial Acoustics (IAC).
2. Industrial Noise Control, Inc.
3. McGill AirFlow LLC.
4. Price Industries, Inc.
5. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated, Hospital grade "Clean Flow".
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.

3. Rectangular elbow with splitters or baffles.
  4. Round elbow with center bodies or pods.
  5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.
- E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel.
1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
  2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
  3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.05 inch thick.
  4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.
- F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch-diameter perforations.
- G. Special Construction:
1. Suitable for outdoor use.
  2. High transmission loss to achieve STC 45.
- H. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- I. Principal Sound-Absorbing Mechanism:
1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
  2. Film-lined type with fill material.
    - a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
    - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
  3. Lining: Mylar or Tedlar.
- J. Fabricate silencers to form rigid units that shall not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
1. Joints: Lock formed and sealed or flanged connections.
  2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
  3. Reinforcement: Cross or trapeze angles for rigid suspension.
- K. Packless, tubular type sound attenuators shall be utilized in fume hood/general exhaust ducts.
- 2.9 TURNING VANES
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Elgen Manufacturing.
  4. METALAIRE, Inc.
  5. SEMCO Incorporated.

6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  - B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
    1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
  - C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
  - E. Vane Construction: Single wall for ducts up to 24 inches wide and double wall for larger dimensions.
- 2.10 REMOTE DAMPER OPERATORS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    1. Pottorff.
    2. Ventfabrics, Inc.
    3. Young Regulator Company.
  - B. Description: Cable system designed for remote manual damper adjustment.
  - C. Tubing: Brass.
  - D. Cable: Steel.
  - E. Wall-Box Mounting: Recessed.
  - F. Wall-Box Cover-Plate Material: Stainless steel.
- 2.11 DUCT-MOUNTED ACCESS DOORS
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    1. American Warming and Ventilating; a division of Mestek, Inc.
    2. Cesco Products; a division of Mestek, Inc.
    3. Ductmate Industries, Inc.
    4. Elgen Manufacturing.
    5. Flexmaster U.S.A., Inc.
    6. Greenheck Fan Corporation.
    7. McGill AirFlow LLC.
    8. Nailor Industries Inc.
    9. Pottorff.
    10. Ventfabrics, Inc.
    11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

## 2.12 FLEXIBLE CONNECTORS (AT FANS)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Elgen Manufacturing.
  4. Ventfabrics, Inc.
  5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F.
- F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz./sq. yd..
  2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
  3. Service Temperature: Minus 67 to plus 500 deg F.



- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.13 FLEXIBLE DUCTS (AT AIR DEVICES)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Flexmaster, Type 8M Insulated.
  - 2. Thermaflex, Type M-KE
- B. Application: Low pressure ductwork connections to air inlets and outlets and linear diffuser plenums, where indicated on drawings.
- C. Description: Insulated lightweight, spiral wound wire reinforced foil or plastic film type flexible duct with acoustic performance ratings per ASTM E-477 or ADC FD-72RI.
- D. Acoustical Performance: Tested in accordance with ASTM E-477 and/or ADC Test Code FD-72RI, Attenuation-Insertion Loss for 10 Foot Length, Zero Flow, shall be as follows:
- E.

OCTAVE BAND								
CENTER FREQ (HZ)	63	125	250	500	1K	2K	4K	8K
6 inch diameter	--	8	20	6	39	39	23	--
8 inch diameter	--	8	12	29	35	36	21	--
12 inch diameter	--	20	26	26	32	26	13	--

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.15 BACKDRAFT RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Air Balance Inc.; a division of Mestek, Inc.
  - 2. American Warming and Ventilating; a division of Mestek, Inc.
  - 3. Cesco Products; a division of Mestek, Inc.
  - 4. Greenheck Fan Corporation.
  - 5. Lloyd Industries, Inc.
  - 6. Nailor Industries Inc.
  - 7. NCA Manufacturing, Inc.
  - 8. Pottorff.
  - 9. Ruskin Company.
  - 10. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 3-inch wg.
- E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, end pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
  - 1. Material: Aluminum.
  - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball.
- M. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.
  - 3. Electric actuators.
  - 4. Chain pulls.

2.16 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Air Balance Inc.; a division of Mestek, Inc.
  - 2. American Warming and Ventilating; a division of Mestek, Inc.
  - 3. Cesco Products; a division of Mestek, Inc.
  - 4. Greenheck Fan Corporation.
  - 5. Lloyd Industries, Inc.
  - 6. Nailor Industries Inc.
  - 7. NCA Manufacturing, Inc.
  - 8. Pottorff.
  - 9. Ruskin Company.
  - 10. Vent Products Company, Inc.
- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 1250 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: Hat-shaped, 0.063-inch-thick extruded aluminum, with welded corners or mechanically attached and mounting flange.
- F. Blades:
  - 1. Multiple, 0.025-inch-thick, roll-formed aluminum.
  - 2. Maximum Width: 6 inches.
  - 3. Action: Parallel.
  - 4. Balance: Gravity.
  - 5. End pivoted.
- G. Blade Seals: Neoprene.
- H. Blade Axles: Aluminum.
- I. Tie Bars and Brackets:
  - 1. Material: Aluminum.
  - 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Bearings: Bronze.
- L. Accessories:
  - 1. Flange on intake.
  - 2. Adjustment device to permit setting for varying differential static pressures.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers rigidly.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. At drain pans and seals.
  - 3. Downstream from manual volume dampers, control dampers and equipment.
  - 4. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 5. At each change in direction and at maximum 50-foot spacing.
  - 6. Upstream from turning vanes.
  - 7. Upstream or downstream from duct silencers.
  - 8. Control devices requiring inspection.
  - 9. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.

- 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23, Identification for HVAC Piping and Equipment to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to rotating equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect air devices for supply and return where located in accessible ceilings with maximum 72 inch lengths and minimum 60 inch length of flexible duct clamped or strapped in place. Exhaust is hard ducted.
- P. Install duct test holes where required for testing and balancing purposes.
- Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\233300-AIR DUCT ACCESSORIES.DOC

## SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Square ceiling diffusers.
2. Perforated returns and exhausts.
3. Linear slot diffusers.
4. Radial flow diffuser.
5. Adjustable bar registers.

- B. Related Sections:

1. Division 08 for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.
  4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  5. Duct access panels.
- B. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 CEILING DIFFUSERS

#### A. Square Ceiling Diffusers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Krueger.
  - d. Nailor Industries Inc.
  - e. Price Industries.
  - f. Titus.
  - g. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel. Provide with aluminum construction where located in areas with roll-up doors (1<sup>st</sup> floor north wing on east side).
4. Finish: Baked enamel, color selected by Architect.
5. Face Size: 24 by 24 inches.
6. Face Style: Three cone, or plaque, as scheduled on drawings.
7. Mounting: Surface or T-bar. Coordinate with reflected ceiling plans.
8. Pattern: Adjustable.
9. Dampers: Radial opposed blade.
10. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Safety chain.
  - d. Wire guard.
  - e. Sectorizing baffles.
  - f. Operating rod extension.

B. Perforated Returns and Exhausts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Krueger.
  - d. Nailor Industries Inc.
  - e. Price Industries.
  - f. Titus.
  - g. Tuttle & Bailey.
2. Material: Steel backpan, with steel face. Provide with aluminum construction where located in areas with roll-up doors (1<sup>st</sup> floor north wing on east side).
3. Finish: Baked enamel, color selected by Architect.
4. Face Size: 24 by 24 inches.
5. Duct Inlet: Round.
6. Face Style: Flush.
7. Mounting: Surface or T-bar. Coordinate with reflected ceiling plans.
8. Dampers: Radial opposed blade.
9. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Safety chain.
  - d. Wire guard.
  - e. Operating rod extension.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Krueger.
  - d. Nailor Industries Inc.
  - e. Price Industries.
  - f. Titus.



- g. Tuttle & Bailey.
- 2. Devices shall be specifically designed for variable-air-volume flows.
- 3. Material - Shell: Steel, noninsulated.
- 4. Material - Pattern Controller and Tees: Aluminum.
- 5. Finish - Pattern Controller: Baked enamel, black.
- 6. Finish - Tees: Baked enamel, color selected by Architect.
- 7. Slot Width: 1 inch.
- 8. Number of Slots: as scheduled.
- 9. Accessories: Frames suitable for ceiling mounting. Coordinate with reflected ceiling plans.

## 2.3 HIGH-CAPACITY DIFFUSERS

### A. Radial Diffuser:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Krueger.
  - d. Nailor Industries Inc.
  - e. Price Industries.
  - f. Titus.
  - g. Tuttle & Bailey.
- 2. Airflow Principle: 180 degree air pattern unless indicated otherwise on drawings.
- 3. Material: Steel. Provide with aluminum construction where located in areas with roll-up doors (1<sup>st</sup> floor north wing on east side).
- 4. Finish: Baked enamel, color selected by Architect.
- 5. Connections: Round.
- 6. Mounting: Coordinate with reflected ceiling plans.
- 7. Accessories:
  - a. Opposed-blade steel damper.

## 2.4 REGISTERS AND GRILLES

### A. Adjustable Bar Register:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

- a. Anemostat Products; a Mestek company.
  - b. Carnes.
  - c. Krueger.
  - d. Nailor Industries Inc.
  - e. Price Industries.
  - f. Titus.
  - g. Tuttle & Bailey.
2. Material: Steel.
  3. Finish: Baked enamel, color selected by Architect.
  4. Front Blade Arrangement: Horizontal spaced 3/4 inch apart.
  5. Core Construction: Integral.
  6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
  7. Frame: 1 inch wide.
  8. Mounting: Countersunk screw.
  9. Damper Type: Adjustable opposed blade, double deflection.

## 2.5 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\233713-DIFFUSERS, REGISTERS, AND GRILLES.DOC

## SECTION 238216 - AIR COILS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following types of air coils that are an integral part of air-handling or supplemental units:
  - 1. Hot-water.
  - 2. Chilled-water.
  - 3. Energy Recovery/pre-heat.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.
- B. Shop Drawings: Diagram power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.
- B. Field quality-control test reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. ASHRAE Compliance:

1. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
2. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

#### 1.7 PROJECT CONDITIONS

- A. Altitude above Mean Sea Level: 200 feet.

### PART 2 - PRODUCTS

#### 2.1 WATER COILS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  1. Aerofin Corporation.
  2. Carrier Corporation.
  3. Dunham-Bush, Inc.
  4. Heatcraft Refrigeration Products LLC; Heat Transfer Division.
  5. Precision coils.
  6. Trane.
- B. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.
- C. Minimum Working-Pressure/Temperature Ratings: 200 psig, 325 deg F.
- D. Source Quality Control: Factory tested to 300 psig.
- E. Tubes: ASTM B 743 copper, minimum 0.035 inch thick.
- F. Fins: Aluminum, minimum 0.010 inch thick.
- G. Headers: Cast iron, copper or steel with drain and air vent tappings.
- H. Frames: Galvanized-steel channel frame for heating coils, 304 stainless steel for cooling and energy recovery/preheat coils, minimum 0.0625 inch thick for slip-in mounting.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

- B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install coils level and plumb.
- B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- C. Install double wall sloped stainless-steel drain pan under each cooling and energy recovery coil.
  - 1. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1.
  - 2. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
  - 3. Extend drain pan upstream and downstream from coil face.
  - 4. Extend drain pan under coil headers and exposed supply piping.
- D. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.
- E. Straighten bent fins on air coils.
- F. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to coils to allow service and maintenance.
- C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 23, Instrumentation and Control for HVAC, and other piping specialties are specified in Division 23, Hydronic Piping.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 238216

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\238216-AIR COILS.DOC

## SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Certain requirements common to all the mechanical and electrical trades (Fire Suppression, Plumbing, HVAC, Electrical, and Tele/Data) are specified in Division 20, HVAC, Section 200000, "Common Mechanical and Electrical Requirements." To avoid repetition, they are not repeated in each relevant Division of the Specifications. However, these requirements are applicable to the work of this Division, and are hereby incorporated by reference.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

#### 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

#### 1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways and busways will be clear of obstructions and of the working and access space of other equipment.



- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."
- E. Coordinate connection requirements for equipment provided by other trades with equipment submittals and vendor-specific requirements prior to installation and electrical rough-in, including verification of exact location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.
- F. Coordinate connection requirements for equipment provided by Owner and Architect with the equipment submittals prior to ordering and delivery of associated wiring devices, installation of associated wiring devices and electrical rough-in.

#### 1.6 MATERIALS AND WORKMANSHIP

- A. Work shall be neat and rectilinear to building structure. Install material and equipment in accordance with manufacturers written instructions. Installation shall operate safely and without noise, vibration or corrosion. Work shall be properly and effectively protected, and raceway openings shall be temporarily closed to prevent obstruction and damage before completion.
- B. Except as specified otherwise, material and equipment shall be new, factory tested and delivered ready for field installation. Provide supplies, accessories and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents. Equipment damaged during installation shall be repaired to new condition or replaced with new material. The Contractor shall be responsible for all costs associated with testing, replacing to repair, including but not limited to, all replacement or repair costs, preparations prior to testing, all testing costs, extended warranties, re-commissioning of the equipment, etc. with no additional cost to the contract.
- C. The Contractor shall take steps necessary to ensure that all materials and equipment can be delivered and installed in sections sufficiently small to fit within openings in the building and that the weight and size of all equipment pieces so not exceed the capacity of the hoisting and/or elevator system.
- D. Owner will not be responsible for material and equipment before testing, commissioning, and acceptance.

#### 1.7 EQUIPMENT LOCATION

- A. Location of outlets and devices shall be verified with the Architect prior to roughing in. Refer to details and elevations on the architectural drawings. Mounting heights indicated on the Architectural Drawings shall take precedence over information indicated on the Electrical Drawings.
- B. If discrepancies regarding the locations of outlet boxes exist between the Electrical Drawings and any other drawings associated with the Project, notify the Architect. Any reasonable change in location of outlets shall not involve additional expense to Owner. The term "reasonable" shall be interpreted as moving outlet 10'-0" in any direction from the location indicated on the Electrical Drawings.

## 1.8 CABLE TERMINATION TEMPERATURE RATINGS

- A. All equipment terminations connecting to wire and cable, rated 600V or less shall be rated for 75°C for conductors 1 AWG and smaller and/or where conductor ampacities are 100 A or less.

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### 2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.4 ACCESS AND ACCESS PANELS

- A. This Section supplements requirements of Division 08.
- B. Description: Interior construction access panels.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Milcor
  - 2. Knapp
  - 3. Nystorm
  - 4. Inland Steel
- D. Coordinate selection with other Sections supplying similar access panels.
- E. Access panels shall have same fire rating classification as surface penetrated.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to satisfaction of Architect and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.
- C. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel provided under other Sections.
- D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall or ceiling mounting of equipment as required.
- E. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.
- F. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.
- G. Structural steel and hardware shall conform to Standard Specifications of ASTM; use of steel and hardware shall conform to requirements of Section Five of Code of Standard Practice for Steel Buildings and Bridges.
- H. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly which may void warrantee. Report in writing to Architect, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.
- I. No equipment, ductwork, or piping foreign to the electrical installation shall be installed or pass through any room in which electrical systems or equipment is located, such as electrical room, electric closets telephone or data closets. The Electrical Contractor shall notify the Construction Manager of such violations and request removal of such equipment, ductwork, or piping.

- J. Coordinate location of variable frequency controllers, panelboards, transformers and other electrical equipment installed in mechanical rooms with the associated subcontractors. No piping, ductwork or other mechanical equipment shall be allowed to pass through the area of the electrical equipment equal to the width and depth of the electrical equipment extending from floor to structural ceiling above. A hung or gypsum board ceiling is not considered structure.
- K. Give right of way to piping systems installed at a required slope and/or specific mounting height or elevation.
- L. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- M. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- N. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- O. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping."
- C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

### 3.5 HVAC, PLUMBING AND FIRE PROTECTION CONNECTIONS

- A. General
  - 1. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.
  - 2. HVAC, Plumbing and Fire Protection equipment is defined as products provided under other divisions that require power 120 volts and higher.
  - 3. Provide conduit and power wiring for connection to alarm panels, remote alarms, etc. Refer to HVAC, Plumbing and Fire Protection drawings for location and quantity of panels/alarms to be connected. Provide connections from local 120-volt panel via 20 ampere circuit breaker.
- B. Coordination
  - 1. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.
- C. Examination
  - 1. Examine the areas and conditions under which the equipment is to be installed.
  - 2. Verify that equipment is ready for electrical connection, wiring, and energization.

D. Installation

1. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
2. Make conduit connections to vibrating equipment using flexible conduit. Use liquid tight flexible conduit in damp or wet locations.
3. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
4. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes for vibrating equipment.
5. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
6. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.
7. Each motor terminal box shall be connected with a minimum 12", maximum 24" piece of flexible conduit to a fixed junction box. A green wire run through the flexible conduit shall interconnect the motor frame and the branch circuit ground wire. Use liquid tight flexible metal conduit for connection. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
8. Check for proper rotation of each motor.

E. Building Management Panels

1. Provide conduit and power wiring (120 volt) to all Building Management System Panels, Direct Digital Control panels, Utility Monitoring System (UMS) panels, etc. Provide connection from local 120 volt panel via 20 ampere circuit breaker. Provide one branch circuit for every panel, unless directed otherwise. Coordinate power and circuiting requirements with associated system vendors.

3.6 ACCESS PANELS

- A. Provide access panels in accordance with this Section and requirements of Division 08.
- B. Access panels are generally not shown on the drawings, but shall be provided to allow access to system components.
- C. Provide proper access to materials and equipment that require inspection, replacement, repair or service, and coordinate their delivery with the installing Trade. If proper access cannot be provided, confer with Architect as to best method of approach for minimizing effect of reduced access which may result.
- D. Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to a representative of the installing Trade. Furnish and install distinctively colored buttons (color as selected by Architect) in finished ceiling to identify all access panels.
- E. Provide access panels to all items requiring maintenance including at fire dampers, volume dampers, controls, shut-off valves, control valves, check valves, or other items that require access and are concealed in floor, wall, furred space or above ceiling.
- F. Ceilings consisting of lay-in or removable splined tiles do not require access panels and dampers, splitters, or test hole openings above ceiling shall have location marked with thumb tack on finished ceiling panel. Location shall be noted on record drawings.
- G. Access panels shall have same fire rating classification as surface penetrated.

- H. Panels within 8" of the surface being penetrated shall be the sized for the greater of 12"x12" or size required to allow removal of the component being maintained; panels further than 8" from the surface being penetrated and access at all equipment requiring service (including disconnects) shall be a minimum of 24"x24". Access doors to fire dampers shall be a minimum of 18"x16" if fire damper is within ordinary person's arms reach of the access panel or 24"x24" if beyond arms reach as required by NFPA 90A-2002.

### 3.7 CONNECTIONS TO OWNER AND ARCHITECT EQUIPMENT

#### A. General

- 1. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source to Owner and architectural equipment for complete and operational equipment.
- 2. Owner and Architectural equipment includes, but is not limited to, the following:
  - a. Coffee machines
  - b. Vending machines
  - c. Microwaves
  - d. Cooktops
  - e. Ovens
  - f. Ranges
  - g. Laundry Washers
  - h. Laundry Dryers
  - i. Refrigerators
  - j. Freezers
  - k. Dishwashers
  - l. Projector screens
  - m. Motorized doors
  - n. Electric hand dryers

#### B. Coordination

- 1. Coordinate location of equipment with Architect and Owner.
- 2. Review equipment submittals prior to ordering and delivery of associated wiring devices, installation of associated wiring devices and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.
- 3. Obtain wiring diagrams and installation methods from equipment manufacturers.

#### C. Examination

- 1. Examine the areas and conditions under which the equipment is to be installed.
- 2. Verify that equipment is ready for electrical connection, wiring, and energization.

#### D. Installation

- 1. Make conduit connections to vibrating equipment using flexible conduit. Use liquid tight flexible conduit in damp or wet locations.
- 2. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- 3. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes for vibrating equipment or for cord drops from ceilings.
- 4. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.

5. Each motor terminal box shall be connected with a minimum 12", maximum 24" piece of flexible conduit to a fixed junction box. A green wire run through the flexible conduit shall interconnect the motor frame and the branch circuit ground wire. Use liquid tight flexible metal conduit for connection. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
6. Check for proper rotation of each motor.

### 3.8 CLEANING

- A. Cleaning shall be performed on a day-to-day basis and a final cleaning prior to commissioning.
- B. Equipment
  1. All electrical equipment shall be cleaned inside and out prior to initial energizing.
  2. Cleaning shall consist of vacuuming busses, windings, enclosures (inside and out), etc. After vacuuming is complete, the equipment shall be wiped down.
  3. If equipment is wet or contains moisture, it shall be thoroughly dried out and inspected by the manufacturer's representative before energizing.
- C. Raceways
  1. All raceways shall be blown out and dried prior to installation of conductors.
  2. Raceways installed in or below the slab shall have a mandrel pulled through to clear any dirt and debris.
- D. Pull, Junction, Work and Floor Boxes
  1. All boxes shall be cleaned of debris such as plaster and concrete residue prior to installation of conductors.
  2. Vacuum all dirt and debris from floor boxes prior to installing inserts.
- E. Electrical Rooms
  1. Upon completion of cleaning equipment, raceways and boxes, but before energizing equipment, the entire room shall be swept clean with all garbage removed from the area.
  2. When the room is clean and equipment energized, the area shall remain clean and the doors to the room shall remain closed until completion of project.
  3. If the room or equipment is subjected to dust or moisture after energizing the equipment shall be de-energized and re-cleaned as outlined above.
- F. Final Cleaning
  1. All light fixtures, devices, device plates, etc., shall be cleaned and left in new condition to the satisfaction of the Architect, prior to final occupancy.
  2. All rubbish, discarded materials and unused materials shall be removed from site.

END OF SECTION 260500

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260500\_100CD\_COMMON ELEC WORK RESULTS.DOC



## SECTION 260519 - LOW-VOLTAGE CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Submit product data for all items specified under this Section in a single comprehensive Product Data Submittal Package. Submittals that do not include each specified unit or contain incomplete submittal information will be rejected.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.
- D. Comply with NECA WC 70.
- E. Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide"

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. Alpha Wire.
  2. American Insulated Wire Corp.; a Leviton Company.
  3. General Cable Technologies Corporation.
  4. Houston Wire and Cable.
  5. Senator Wire & Cable Company.
  6. Southwire Company.
- B. Description: Copper conductors, complying with ASTM B-496.
- C. Conductor Insulation:
1. THHN/THWN-2: Comply with UL 83.
  2. XHHW-2: Comply with UL 44.

### 2.2 METAL-CLAD CABLE, TYPE MC

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. AFC Cable Systems, Inc.
  2. Encore Wire Corporation.
  3. Southwire Company.
- B. Description: Factory assembly of one or more current-carrying, color-coded, insulated conductors in an overall metallic sheath.
1. Conductors: Soft-drawn copper with THHN/THWN-2 or XHHW-2 insulation.
    - a. Ground Conductor: Insulated, green.
  2. Armor: Interlocked aluminum or galvanized steel.
  3. Conductor Assembly Covering: Polypropylene tape.
  4. UL listed for use in air-handling spaces.
  5. Listed for use with UL 1479 – 1, 2 and 3 hour through-penetration firestop systems.
  6. Comply with UL 83, 1569, 1581, and 2556 for type MC.

### 2.3 MINERAL-INSULATED CABLE, TYPE MI

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. Tyco Thermal Controls/Pyrotex System 1850.
- B. Description: 2-Hour fire-rated cable assembly with solid copper conductors encased in compressed metal oxide within a seamless soft-drawn copper metal sheath.

1. Conductors: Copper, complying with ASTM B 3.
  2. Insulation: Highly-compressed magnesium oxide (MgO.)
  3. Comply with UL 2196 for 2-hour fire resistive cable.
  4. Cable Marking: Conductor size, voltage and UL fire resistive classification number.
  5. Direct-Buried Applications: Provide PVC over-jacket.
- C. Mineral-Insulated Cable Terminations and Splices: Compatible with and as recommended by MI cable manufacturer:
1. Conductors No. 10 AWG and Smaller: Tyco Thermal Controls / Pyrotenax Model Pyro-Pak Installation Sheet 545 or equivalent.
  2. Conductors No. 8 AWG and larger: Tyco Thermal Controls / Pyrotenax Model Quick-Term Installation Sheet 638 or equivalent.
  3. Cable Splice: Tyco Thermal Controls / Pyrotenax Model Installation Sheet 550 or equivalent.
  4. Support Hardware: As approved by MI cable manufacturer.

## 2.4 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. AFC Cable Systems, Inc.
  2. Hubbell Power Systems, Inc.
  3. O-Z/Gedney; EGS Electrical Group LLC.
  4. 3M; Electrical Products Division.
  5. TE Connectivity Ltd.
  6. Thomas and Betts Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Copper Conductor Terminations: No. 6 AWG and larger copper conductors shall be connected with bolt-on compression connectors by Thomas & Betts (or approved equal) sized as required by codes and specifically intended to connect copper wire and cable to panelboards, substations, disconnect switches, and other equipment. Install with hydraulic crimping tool as required by manufacturer's recommendations, to ensure permanent high conductivity connection.
1. Terminations: Thomas & Betts Series 54200 (or approved equal) two hole connectors shall be used. Exceptions are as follows:
    - a. Where equipment or device cannot be provided by the manufacturer to accept two hole connectors, T&B Series 54100 (or approved equal) single hole connectors with anti-rotation lug or restraint shall be used.
    - b. Where equipment or devices cannot be provided by the manufacturer to accept either two-hole or single-hole compression connectors, set screw type connectors may be submitted. For a set screw connector to be considered by the Engineer, the manufacturer shall provide certification with his/her equipment submittals that his/her equipment will not accommodate the required compression connectors.

2. Copper to Copper Splices, if allowed, shall be with T&B Series 54500 (or approved equal) compression connectors.
3. Tapping of Copper Conductors shall be with T&B Series 54700 (or approved equal) compression taps.
4. All No. 8 AWG and smaller solid conductors shall be spliced with pre-insulated spring connectors. Connectors shall be Skotch-lok, Buchanan B-Cap or approved equal.
5. For NEC Class 1, 2 or 3 wiring, No. 10 AWG and smaller stranded conductors and terminated with AMP, Inc. "PIDG", UL listed premium grade insulated compression fork connectors or approved equal and shall be spliced in a junction box with AMP, Inc. "Plastic-Grip" UL listed, standard grade insulated butt splices or approved equal. All motor branch circuit conductors terminating at the motor termination box shall be spliced with compression type connectors.

## 2.5 CABLE SUPPORTS

- A. Manufacturers: Basis-of-design is O.Z./Gedney to establish standards of quality for materials and performance. The naming of a specific manufacturer or catalog number does not waive any requirements or performance of individual components described in the specification. Acceptable alternate manufacturers are: Cross Hinds, Kellem or the Engineer's approved equal.
- B. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
- C. Provide split wedge cable supports with clamps for cable without metallic sheath. Provide basket weave or approved equal cable supports approved by cable manufacturer for cable with metallic sheath.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Service Entrance: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Comply with utility requirements.
- B. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR AND CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Service Entrance, Feeders and Branch Circuits Requiring Fire-Resistance Rating: 2-House fire-rated MI cable.
- C. Underground Feeders and Branch Circuits, including below Slabs-on-Grade: Type XHHW-2, single conductors in raceway.

- D. Exposed Feeders and Branch Circuits, Including in Crawlspace: Type THHN-THWN-2, single conductors in raceway.
- E. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN-2, single conductors in raceway; except MC-cable may be used for non-emergency branch circuits.
- G. Feeders and Branch Circuits Concealed in Concrete within Buildings: Type THHN-THWN-2, single conductors in raceway
- H. Feeders and Branch Circuits Installed below Raised Flooring: Type THHN-THWN-2, single conductors in raceway.
- I. VFC Output Circuits: Type XHHW-2, single conductors in raceway.
- J. Feeders and Branch Circuits Requiring Fire-Resistance Rating: 2-Hour fire-rated MI cable.
- K. Class 1 Control Circuits: Type THHN-THWN-2, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN-2, in raceway.
- M. Control Circuits Requiring Fire-Resistance Rating: 2-Hour fire-rated MI cable.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Provide fire-stopping at penetrations of fire-rated construction in accordance with Division 07.
- F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."
- H. MI Cables:
  - 1. Prior to cable installation, meet with cable manufacturer to review all aspects of the proposed installation. Provide certification from the cable manufacturer as part of the Product Data submittal package that they have reviewed and approved the proposed installation.
  - 2. Terminations:
    - a. Make field made terminations using approved cable manufacturer termination kits only.

- b. Complete terminations immediately once started to avoid moisture ingress from surrounding air. Prior to completing each termination, test insulation resistance and follow manufacturer's drying procedures until insulation resistance reaches an acceptable level.
  - c. Use 1/4-inch thick brass connection plates when connecting to ferrous cabinets with single conductor cables. Install connection plates per manufacturer's drawings. Provide supplementary transition enclosure when connecting to equipment that has an enclosure that cannot be modified without voiding its listing or warranty. Connections to enclosures shall be made with manufacturer approved glands.
  - d. Once cable is connected to equipment or transition enclosure, convert to stranded cable and make final connections to equipment lugs.
3. Sheath Induction Reduction:
- a. When multi-phase circuits have paralleled single conductors, cables shall be run in groups having one of each phase in each group.
  - b. Each set of paralleled conductors shall be separated by at least 2.15 single cable diameters.
  - c. Each group of cables shall be fastened tightly together, at least once between each cable support on horizontal runs and twice on vertical runs, using 1/2-inch wide by 0.030 inch thick stainless steel straps.
4. Exposed and Surface Installations:
- a. Cable may be secured directly to fire-rated building structure using an approved method such as one, or any combination, of the following:
    - 1) Straps: 1/2-inch wide x 3-1/2 inch long by 0.030 thick stainless steel or copper straps. Each strap shall contain two 1/4-inch holes for securing with 3/16-inch by minimum 1-3/4 inch long steel anchors.
    - 2) Steel struts
    - 3) Steel cable tray.
  - b. Distance between cable supports shall not exceed six feet on-center horizontally, or six feet on-center vertically.
5. Embedded Installations:
- a. Cables will be run in the same trifoil or quadfoil configuration as exposed installations.
  - b. Protect against damage during pulling, and during concrete pouring or backfill and tamping.
  - c. Provide protective polymer cable jacket when recommended by cable manufacturer for applicable installation.
6. Wall and Floor Penetrations:
- a. Provide sleeves to protect cable and penetration opening during cable installation.
  - b. Provide approved sealing and fire stopping of all penetrations.
7. Neatly train and lace cable inside boxes, equipment and panelboards.
- 3.4 METAL-CLAD (MC) CABLE RESTRICTED WIRING APPLICATIONS
- A. MC-cable shall not be used in the following locations or applications:
- 1. Service drops.

2. Exposed in any space, other than electrical and mechanical rooms.
3. Underground or embedded within concrete.
4. Where subject to physical damage.

### 3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Do not splice power conductors within enclosures of equipment such as switchgear, switchboards, and panelboards.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and all feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
    - a. Distribution panelboard feeders.
    - b. Branch circuit panelboard and load center feeders.
    - c. Emergency system circuits.
    - d. Standby system circuits.
  2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260519\_100CD\_LOW-VOLTAGE CONDUCTORS AND CABLES.DOCX



## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Outdoor equipment grounding.
  - 3. Common ground bonding with lightning protection system.
- B. Equipment grounding system shall be designed so metallic structures, enclosures, raceways, cable tray, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with electrical circuits operate continuously and ground potential and provide low impedance path for possible ground fault currents.

#### 1.3 REFERENCES

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form part of this specification to the extent referenced. Publications are referenced in the text by the basic designations only.
  - 1. NFPA 70, National Electrical Code
  - 2. NFPA 780, Standard for the Installation of Lightning Protection Systems
  - 3. UL 96, UL Standard for Safety for Lightning Protection Systems
  - 4. UL 467, Grounding and Bonding Equipment
  - 5. UL 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors
  - 6. IEEE/ANSI 142, Latest Edition Recommended Practice for Grounding of Industrial and Commercial Power Systems
  - 7. ASTM B3, Solid Conductors
  - 8. ASTM B8, Assembly of Stranded Conductors
  - 9. ASTM B33, Tinned Conductors
  - 10. NEMA GR1, Ground Rods and Ground Rod Couplings

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Submit product data for all items specified under this Section in a single comprehensive Product Data Submittal Package. Submittals that do not include each specified unit or contain incomplete submittal information will be rejected.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
  2. Ground rods.
  3. Ground rings.
  4. Concrete encased electrodes.
  5. Grounding arrangements and connections for separately derived systems.
- C. Field quality-control test reports that include the following.
1. Test procedures used.
  2. Test results that comply with the requirements.
  3. If applicable, results of failed tests and corrective action taken to achieve test results that comply with the requirements.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS and NFPA 70B.
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS

- A. Insulated Feeder and Branch Circuit Equipment Ground Conductors: Copper stranded conforming to ASTM B8 and B33 wire or cable insulated for 600 V sized as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Insulation class other than 600V shall only be provided where otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Grounding Electrode Conductors: Bare, stranded cable of size shown on drawings, specifications or as required by NFPA 70, whichever is larger.
  1. Stranded Conductors: ASTM B 8.
  2. Solid Conductors: ASTM B 3.
- C. Grounding Bus: Provide ground bus where specified and required.
  1. Grounding Bus Material: Rectangular bars of bare copper, 1/4 by 2 inches in cross section, minimum 24 inch length unless otherwise indicated; with insulated standoffs and stainless steel fasteners.
  2. Ground Bus shall be UL 467 listed.

3. Field modification or cut bus shall not be acceptable.

## 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Mechanical Connectors: Provide mechanical connectors of the two bolt type, listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
  1. Pipe Connectors: Clamp type, sized for pipe.
  2. Materials: The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolted pressure type. Split bolt connector types shall NOT be accepted.
  3. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.
- C. Compression Connectors: Provide compression connectors that meet or exceed the performance requirements of IEEE 837, latest revision. Compression connectors shall be listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
  1. Materials: The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.
    - a. The installation of the connectors shall be made with a compression tool and die system as recommended by the manufacturer of the connectors.
    - b. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compressions tool settings.
    - c. Each connector shall be factory filled with an oxide-inhibiting compound.
- D. Welded Connectors: Provide exothermic connections for copper-to-copper and copper-to-steel connections to ground rods, ground buses, ground wires, steel beams, rebar, etc.
  1. The supplier of the equipment shall provide with no additional charge and information or supervision required for the proper installation of the equipment and training of operating personnel
  2. Materials: Conductors spliced with an exothermic welded connection shall be considered as a continuous conductor, as stated in the notes accompanying NEC articles 250.50, 250.64 and IEEE Standard 80 (latest edition).
    - a. Procedures outlined in the Manufacturer's installation instruction shall be followed. Molds shall not be modified during installation in field applications.
    - b. Weld metal shall be a mixture of copper oxide and aluminum. Only one weld metal mixture shall be required for each grounding connection.
    - c. Grounding connections shall be tested and certified in accordance with IEEE 837, UL 486A and UL 467.
  3. All exothermic connections shall:
    - a. Prove to carry more current than the conductor.

- b. Not deteriorate during the life of the connection.
- c. Will not loosen or corrode during the life of the connection.
- d. Resist repeated fault currents without failure.
- e. Be of high visually discerned quality.
- f. Eliminate electrolytic penetration of conductors (strands).

### 2.3 GROUNDING ELECTRODES

- A. Ground Rods: Ground Rods shall be Copper-clad steel; 3/4 inch by 10 feet in diameter unless otherwise specified with a tensile strength not less than 75,000 psi. Copper shall be applied electrologically forming a metallurgical bond between the steel core and the copper.
  - 1. Provide ground rods where shown or required to obtain the ground resistance specified in Part 3.

### 2.4 TEST WELLS

- A. Sized to accommodate ground rod, grounding conductors, and associated connectors to be housed; minimum 12-inch internal diameter.
- B. Construction: Heavy-duty, traffic-rated cylindrical concrete body with open bottom and cast iron cover marked "GROUND" with flush lift-out handle and cast iron frame ring. Well shall be minimum 24-inches deep with sand or gravel fill at bottom.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned prior to connections.
- D. Attach grounds permanently before building service is energized.
- E. Provide bonding to meet Regulatory Requirements.
- F. Examine raceway, equipment or area to receive grounding to provide adequate sizes, placement and materials for a complete installation.
- G. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- H. Determine numbers and sizes of screw terminals for equipment grounding bars in panelboards and other electrical equipment. Provide screw terminals for active circuits, spares and spaces.
- I. Provide equipment ground conductor in same raceway with associated phase conductors.

### 3.2 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Structural Steel: Welded connectors.

### 3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

### 3.4 OUTDOOR EQUIPMENT GROUNDING

- A. Comply with IEEE C2 grounding requirements.
- B. Outdoor Pad-Mounted Electrical Equipment: Install ground ring around the perimeter of concrete pads for outdoor generators, switchgear, transformers, and other electrical equipment. Provide at least two ground rods located at opposite corners of equipment pad and connect to ground ring. Bond ground ring to reinforcing bars of concrete pad in at least two diametrically-opposed locations. Ground pad-mounted equipment and noncurrent-carrying metal items associated with equipment by connecting them to underground cable and grounding electrodes.

### 3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
  - 3. All riser ground wire connections to ground bus shall be exothermic. All equipment ground connections to ground bus shall be mechanical connectors.
  - 4. Use minimum No. 6 AWG copper conductor, or as indicated on the plans, for communications system grounding conductor.

### 3.6 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 12 to 24 inches below finished floor or final grade, unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- D. Test Wells: Ground rod driven through bottom of test well. Install at least one test well for each service, unless otherwise indicated. Install at ground rod electrically closest to each service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ground Ring: Install a supplementary grounding electrode consisting of ground rods and wire around the perimeter of the building and connecting to steel columns. When ground rods are not shown on the drawings provide a ground rod at every other column with a maximum spacing of 40'.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building foundation.
3. The perimeter ground wire shall be bonded to each ground rod with an exothermic connection. Provide a No. 4/0 AWG copper ground wire connections from the grounding loop to columns via exothermic connections.
4. Drive ground rods until tops are 24" below final grade unless installed in ground test well.
5. Ground rods shall be driven to achieve resistance required by this Section. Provide additional rods as required to achieve specified resistance. Where geological conditions dictate, ground wire mesh may be provided or additional rods shall be driven in compacted earth areas as require to meet resistance requirement.
6. Connections to ground loop system shall be made with Exothermic weld.
7. Verify that final backfill and compaction has been completed before driving ground rod electrodes.

I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

### 3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Visual inspection of all systems, raceway and equipment grounds shall be made to determine the adequacy and integrity of the grounding. All ground testing results shall be properly recorded, witnessed, and reported to the Contractor.
2. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
      - 1) Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      - 2) Ground tests shall be performed using a low resistance, Null balance type, ground testing ohmmeter, with test lead resistance compensated for. Measure the resistance of the ground under test and remote earth or a reference ground as specified. The test instrument shall be the type which compensates for potential and current rod resistances.
      - 3) Test completed grounding system at the service disconnect enclosure grounding terminal and at ground test wells. Perform tests, by the fall-of-potential method according to IEEE 81.
      - 4) Testing record shall include drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
  4. Where ground test results indicate the need for additional grounding conductors or rods that are not indicated on drawings or specified, design changes will be initiated to obtain the acceptable values. The Subcontractor is responsible for the proper installation of the grounding shown on drawings or specified and for the correction of improper installations as determined by inspections and tests.
  5. Prepare dimensioned drawings locating each, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system resistance shall be 5 ohms or less.
- C. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260526\_100CD\_GROUNDING AND BONDING.DOC



## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1 Table 1 where maximum spacings listed are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Wood: Fasten with lag screws or through bolts.
  2. To Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
  1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Comply with requirements in Division 09 painting Sections. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260529\_100CD\_ELEC HANGERS AND SUPPORTS.DOCX

## SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section "Underground Electrical Pathways" for underground ductbanks, underground feeders, underground branch circuits and underground utility construction.
  - 2. Division 26 Section "Common Work Results for Electrical" for sleeves.
  - 3. Division 26 Section "Wiring Devices" for floor service fittings.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. RSC: Rigid Steel Conduit.
- C. FMC: Flexible metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
- C. Comprehensive Product Data and Shop Drawing Submittal Package: Submit product data and shop drawing information for all items specified under this Section in a single comprehensive Product Data and Shop Drawing Submittal Package. Submittals that do not include each specified unit or contains incomplete submittal information will be rejected.
- D. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
  2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- E. Source quality-control test reports.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. AFC Cable Systems, Inc.
  2. Alflex Inc.
  3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  5. Electri-Flex Co.
  6. Manhattan/CDT/Cole-Flex.
  7. Maverick Tube Corporation.
  8. O-Z Gedney; a unit of General Signal.
  9. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1; zinc-coated steel.
- C. EMT: ANSI C80.3; zinc-coated steel.
- D. FMC: Spiral wrapped zinc-coated steel with insulated throats.
- E. LFMC: Highly flexible, hot-dipped galvanized steel conduit with PVC jacket with insulated throats.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  2. RSC: Threaded steel insulated bushings and throats. Locknuts shall be steel/zinc plated.
  3. EMT: Steel or die-cast, with insulated bushings and throats:
    - a. Compression type, except set-screw type may be used for 2-inch trade size and larger.
- G. Combination Expansion/Deflection Fittings
1. Fittings shall be threaded, hot dipped galvanized malleable iron or steel with internal bonding jumper.
  2. Fittings shall include bonding jumper, insulated bushing and short nipple.

H. Sealing Fittings

1. Threaded sealing fittings for rigid steel conduits shall be zinc- or cadmium- coated, cast or malleable iron; sealing fittings for aluminum conduit shall be threaded cast aluminum. Fittings that prevent passage of water vapor shall be continuous drain.
2. Sealing fittings shall be filled with a UL listed sealing compound.

I. Cable Terminators

1. Provide cable terminator assemblies by O-Z/Gedney or equal.
2. Assemblies shall have bakelite discs, neoprene rings and sealing compound within a fitting for attachment to raceway.

J. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated. Conduit shall be 100% virgin polyvinyl chloride (PVC), 90°C UL-rated that conforms to industry standards. Conduit, fittings and solvent cement shall be approved by raceway manufacturer to assure system integrity. Material shall have minimum tensile strength of 5,000-6,500 psi at 73.4°F, minimum flexural strength of 12,500 psi, and minimum compressive strength of 9,000 psi.

C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.



- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

#### 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. RACO; a Hubbell Company.
  - 8. Robroy Industries, Inc.; Enclosure Division.
  - 9. Spring City Electrical Manufacturing Company.
  - 10. Thomas & Betts Corporation.
  - 11. Walker Systems, Inc.; Wiremold Company (The).
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
  2. Concealed Conduit, Aboveground: EMT.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  4. Device boxes, Aboveground: Cast metal.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage within Mechanical, Electrical and unfinished areas defined by Architect: EMT.
  2. Exposed and Subject to Physical Damage: Rigid steel conduit with cast metal device boxes. Includes raceways in the following locations:
    - a. Loading docks.
    - b. Mechanical and electrical rooms, below 10'-0" AFF.
    - c. Parking garages.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
    - a. Dry locations: FMC.
    - b. Wet or Damp locations: LFMC.
  5. Damp or Wet Locations: Rigid steel conduit with cast metal device boxes.
  6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
  7. Concealed and Exposed in Vivarium Areas (including Holdrooms, Procedure Rooms, Corridors and General Spaces): Rigid steel conduit with cast boxes.
- C. Raceways Installed Within Slabs (must be approved by Project Structural Engineer):
1. Feeders, branch circuits and low voltage system: RNC, Type EPC-40-PVC.
  2. Penetrations from concrete slabs and elbows shall be made with galvanized RSC and RSC fittings only.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

### 3.2 RACEWAY INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. General

1. Check raceway sizes to determine that green equipment ground conductor fits in same raceway with phase and neutral conductors to meet NEC percentage of fill requirements. Increase duct, conduit, tubing and raceway sizes shown or specified as required to accommodate conductors.
  2. Install raceway systems complete before drawing in conductors. Blow through and swab after plaster is finished and dry, and before conductors are installed. Wire shall not be pulled into raceway until building roof and walls are weather-tight.
  3. Install connectors and couplings as recommended by manufacturers. Compression fittings shall not be used with rigid steel conduit. Set screw fittings shall not be used with rigid conduit. Set-screw connectors for EMT shall be tightened to embed screws in conduit.
  4. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 lb. Tensile strength. Provide at least 12" of slack at each end of pull wire with labels.
  5. Galvanized rigid steel conduit installed in corrosive environments shall have all field cut threads coated with an approved, electrically conductive, corrosion resistant compound so that the current carrying ability of the conduit is not compromised.
  6. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
  7. Penetrate waterproof walls of structural slabs and foundation walls only where approved by Construction Manager. Submit proposed penetration points, size openings and penetration methods to Construction Manager for approval.
  8. All conduit penetrations through exterior foundation walls shall be sealed. Provide sealing assemblies between conduit and sleeve. Provide cable terminators in conduit for cable seal. Provide appropriate sleeve through wall for conduit required. Assembly shall be tightened to seal out water.
  9. Raceways shall be installed in such a way as to not block exit and equipment service space. Raceway on or adjacent to equipment shall be located to allow free access to all removable panels and equipment service.
  10. Minimum Raceway Size: 3/4-inch trade size.
  11. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
  12. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Raceways Installed Underground Below Slab on Grade:
1. Comply with Division 26 Section "Underground Electrical Pathways".
  2. Raceways shall be located on undisturbed earth. Where the earth has been disturbed or is of poor quality excavate a trench to proper subgrade elevation. Place bedding material and compact trench bottom.
  3. Stagger conduit couplings so that couplings on adjacent conduits do not lie in same transverse plane. Provide conduit spacers every five feet.
  4. Elbows transitioning from underground to exposed shall be galvanized RSC. Provide appropriate transition fittings.
  5. Connections between conduits of different types shall be made in approved manner, using adapters and other materials and methods recommended by conduit manufacturers.
  6. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- E. Install no more than the equivalent of four 90-degree bends in any conduit run except for communications conduits, for which two 90-degree bends are allowed.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceways Installed Within Slabs

1. If approved by the Project Structural Engineer, branch circuits may be installed within concrete slabs. Penetrations from concrete slabs and elbows shall be made with galvanized RSC and RSC fittings only.
  2. Raceways shall not be installed within the floor slabs unless specifically allowed by the Project Structural Engineer. Refer to Division 3 for additional information.
  3. When raceways are allowed in slabs the following shall apply:
    - a. Installation shall conform to ACI (American Concrete Institute) 318, Paragraph 6.3, "Conduits and Pipes Embedded in Concrete".
    - b. Maximum conduit trade size: 1"
    - c. Raceways shall not cross in slab. Raceway may be installed within deep decking flute only.
    - d. Coordinate locations with kitchen island and wall partition and arrange stub-ups so curved portions of bends are not visible above the finished slab.
    - e. Connections between conduits of different types shall be made in approved manner, using adapters and other materials and methods recommended by conduit manufacturers.
    - f. After concrete has set, nonmetallic conduits shall be cleared with mandrel of same size as conduit.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- J. Terminations
1. Raceway shall enter and be secured to cabinet, junction box, pull box or outlet box with locknut outside and bushing inside, or with liquid-tight, threaded, self-locking, cold-weld wedge adapter.
  2. Provide additional locknut for rigid conduit and wrench-tighten locknut for EMT or flexible conduit where circuit voltage exceeds 250 V. Locknuts and bushings or self-locking adapters will not be required where conduits are screwed into tapped connections.
  3. Vertical conduit runs that terminate in bottoms of wall boxes or cabinets shall be protected from entrance of foreign material before installation of conductors.
  4. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
  5. Provide insulated bushings on raceways entering all panels, switchboards, motor controllers, VFDs, etc. and all boxes 12" x 12" and larger to protect conductors.
- K. Raceways for Communications Cable:
1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. In garages and other areas in which flammable gases or vapors may be present to prevent transmission of gases or vapors through conduits.
  3. Where otherwise required by NFPA 70.
- M. Expansion/Deflection Fittings
1. Raceway buried or secured rigidly on opposite sides of building expansion joints and long runs of exposed raceway subject to stress due to thermal expansion shall have expansion/deflection fittings. Fittings shall safely deflect and expand to twice distance of structural movement.
  2. Provide separate external copper bonding jumper secured with grounding straps on each end of fitting, when integral ground is not provided.
  3. Raceways buried in concrete shall cross building expansion joints at right angles; provide expansion fittings as required by manufacturer's instructions. Provide insulated bushings at ends of raceways.
  4. Coordinate location of expansion/deflection fittings with the structural and architectural drawings.
- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Box installation:
1. Determine from the drawings and by actual field conditions, the exact location of each outlet. The outlet locations shall be modified from those shown to accommodate changes in door swings or to clear other interferences that may arise from job construction details, as well as modifications to center them within the room spaces. These modifications shall be made with no change in contract price and shall be a matter of job coordination that gets reflected on the as-built drawings.
  2. Check these conditions throughout the entire job and notify the Architect/Engineer or discrepancies, as they may occur, to verify the modifications, if any, before proceeding with the installation.
  3. Install boxes in accordance with manufacturer's written instructions, guidelines and the applicable requirements of the NEC, local codes, the National Electrical Contractors Association's "Standard of Installation" and in accordance with recognized industry practices to ensure that products serve the intended function.
  4. Coordinate location of boxes with millwork, counters, benches and back-splashes denoted on the Architectural and Electrical Drawings.
  5. Coordinate box installation with electrical raceway and cable work, as necessary for proper interface.
  6. Coordinate cutting of masonry walls and drywalls to achieve neat openings for boxes.
  7. Provide all necessary hardware to secure boxes in place.
  8. Sheet metal pull boxes shall be supported adequately to maintain shape. Larger boxes shall have structural steel bracing welded into rigid assembly formed adequately to maintain alignment in shipment and installation. Secure covers with corrosion-resistant screws or bolts.
  9. Provide clamps, grids and other appurtenances to secure cables within pull boxes. No cable shall be unsupported for more than 30".
  10. Provide cable troughs of special shapes, design and construction required to install, support and enclose feeder cable throughout indicated routing. Troughs shall be as specified above for junction and pull boxes, with reinforcing, insulating supports and clamping for cable installation. Cables shall be continuous throughout troughs, and shall be racked in distributed phase groupings arranged with phase cables surrounding neutral conductors.
  11. Location:
    - a. Do not install boxes back to back in same wall.

- b. For boxes mounted in exterior walls install insulation behind the box to prevent condensation in box.
- c. Mount boxes flush with wall in all areas unless noted otherwise on the drawings. Boxes in mechanical rooms may be surface mounted where flush mounting is not possible due to construction.
- d. Provide appropriate fire-stopping for outlet backboxes installed in wall cavities of fire rated partitions. Boxes shall not be installed in walls or partitions of staggered stud construction unless a Wall Opening Protective Material is installed with the box in accordance with classification requirements for the protective materials.
- e. Outlet boxes on opposite sides of a wall shall be spaced at least 24-inches apart. In sound-rated partitions, all five side of outlet backboxes must be sealed using moldable sound insulation putty pads such as the following:
  - 1) Kinetics IsoBarrier (for fire-rated partitions) or equal.
  - 2) Kinetics SealTight (non-fire-rated partitions) or equal.
- f. Junction and pull box covers shall be readily accessible. Do not install junction or pull boxes above suspended ceilings except where ceiling is removable or where access panel is provided.
- g. No pull box shall be within 2 feet of another.
- h. Pull boxes connected to concealed conduits shall be mounted with covers flush with finished wall or ceiling. No aluminum pull box shall be embedded in concrete.
- i. Location of boxes shall be verified with Architect prior to rough-in. Refer to architectural details and elevations.

#### 12. Application

- a. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
- b. Junction or pull boxes exposed to rain or in wet locations shall be weatherproof.
- c. Junction or pull boxes used with aluminum conduit shall be metal compatible with aluminum.

### 3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

### 3.4 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260533\_100CD\_RACEWAYS AND BOXES.DOC

## SECTION 260548 - VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Isolation pads.
  - 2. Spring isolators.
  - 3. Anchorage bushings and washers.
- B. Related Sections include the following:
  - 1. Division 26 Section "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

#### 1.3 DEFINITIONS

- A. IBC: International Building Code.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
- B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
  - 2. Field-fabricated supports.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

- B. Type A - Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to minimum 1/4-inch-thick, neoprene rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
7. Corrosion resistance where exposed to corrosive environment with:
  - a. Spring cadmium plated or electro-galvanized
  - b. Hardware cadmium plated
  - c. All other metal parts hot dip galvanized

- C. Type B - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.



4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

D. Type C - Elastomer Hanger Rod Isolators: Double deflection spring isolators.

1. Molded unit type neoprene element with projecting bushing lining rod clearance hole.
2. Neoprene element to be minimum 1-3/4" thick.
3. Steel retainer box encasing neoprene mounting.
4. Clearance between mounting hanger rod and neoprene bushing shall be minimum of 1/8".
5. Minimum static deflection of 0.35".

E. Type D - Double Deflection Neoprene Mountings.

1. Non-skid top and bottom surfaces.
2. Threaded bolting sleeve for equipment attachment.
3. Baseplate with punched holes attachment to structure.

F. Type E - Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.
2. 0.75" minimum thickness, 50 psi maximum loading, ribbed or waffled design, or opposed cylindrical supports.
3. Minimum 0.1" deflection.
4. 1/16" galvanized steel plate between multiple pad layers.
5. Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.

## 2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION ISOLATION

- A. Isolation systems shall be installed in strict accordance with the manufacturer's written instructions. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.
- B. Equipment Isolation Installation
  - 1. Place floor mounted equipment on minimum 4" high concrete housekeeping pads properly doweled or expansion shielded to the deck. Mount vibration isolators and/or bases on housekeeping pads. Concrete work specified in other Divisions.
  - 2. The minimum operating clearance under inertia bases shall be 2".
  - 3. The minimum operating clearance under other bases shall be 1".
  - 4. All bases shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the machine, isolators.
  - 5. The isolators shall be installed without raising the equipment except for neoprene waffle pads installed under equipment enclosures. Pads are to be laid out in this instance before the equipment is set in place.
  - 6. After the entire installation is complete, and under full operational load, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free in all directions.
  - 7. Install equipment with flexibility in wiring. Provide flexible piping and conduit connections between vibrating equipment and fixed building structure to minimize vibration transmission.
  - 8. Install equipment in accordance with Table A.

TABLE A											
			Equipment Installation Attachment Point								
			Lowest Building Level			Intermediate Bldg. Levels			Roof		
EQUIPMENT	SIZE	MOUNTING	ISOL	MIN DEFL	BASE	ISOL	MIN DEFL	BASE	ISOL	MIN DEFL	BASE
Vibration Isolation – Requirements for Electrical Equipment											
*POWER TRANSFORMER	ALL	FLOOR	E	.2	--	--	--	--	--	--	---
DISTRIBUTION TRANSFORMER (DRY TYPE)	ALL	FLOOR	E	.2	--	D	.3	--	--	--	--
		CEILING	C	.2	--	C	.2	--	--	--	--
**GENERATORS	ALL	FLOOR	B	.75	--	B	1.5	--	B	1.5	--
*In addition to the field installed isolators, the transformer base shall be factory equipped with the appropriate isolators as detailed in the transformer or unit substation specification.											
**The generator isolation shall be approved by the generator set manufacturer.											

- C. Install three foot FMC or LFMC connection to vibrating equipment enclosure.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260548\_100CD\_VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS.DOC

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables and conductors.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated. Submit product data for all items specified under this Section in a single comprehensive Product Data Submittal Package. Submittals that do not include each specified unit or contain incomplete submittal information will be rejected.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

### 2.2 CONDUCTOR AND CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

### 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.

### 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

### 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Accessible Raceways and Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
  - 3. Combined Fire Alarm and Security System: Red and blue.
  - 4. Security System: Blue and yellow.
  - 5. Mechanical and Electrical Supervisory System: Green and blue.
  - 6. Telecommunication System: Green and yellow.
  - 7. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Switchgear and switchboards.
    - b. Panelboards.
    - c. Uninterruptible power supplies.
    - d. Power transfer switches.
    - e. Controls with external control power connections.
  2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- I. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
  2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and other emergency operations.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  2. Equipment to Be Labeled:
    - a. Panelboards, electrical cabinets, and enclosures.



- b. Access doors and panels for concealed electrical items.
- c. Electrical switchgear and switchboards.
- d. Transformers.
- e. Electrical substations.
- f. Emergency system boxes and enclosures.
- g. Motor-control centers.
- h. Disconnect switches.
- i. Enclosed circuit breakers.
- j. Motor starters.
- k. Push-button stations.
- l. Power transfer equipment.
- m. Contactors.
- n. Remote-controlled switches, dimmer modules, and control devices.
- o. Battery inverter units.
- p. Battery racks.
- q. Power-generating units.
- r. Voice and data cable terminal equipment.
- s. Master clock and program equipment.
- t. Intercommunication and call system master and staff stations.
- u. Television/audio components, racks, and controls.
- v. Fire-alarm control panel and annunciators.
- w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- x. Monitoring and control equipment.
- y. Uninterruptible power supply equipment.
- z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208Y/120-V Circuits:

- a. Phase A: Black.
  - b. Phase B: Red.
  - c. Phase C: Blue.
3. Colors for 480Yh/277-V and 480-V Circuits:
- a. Phase A: Brown.
  - b. Phase B: Orange.
  - c. Phase C: Yellow.
4. Colors for 120/240-V Circuits:
- a. Phase A: Black.
  - b. Phase B: Red.
5. Colors for Neutral Conductors in Raceways Containing Multiple Circuits: White with colored stripe to match color of associated phase conductor.
6. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- J. Painted Identification: Prepare surface and apply paint according to painting Sections.

END OF SECTION 260553

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260553\_100CD\_IDENTIFICATION FOR ELECTRICAL SYSTEMS.DOC

## SECTION 260923 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Indoor occupancy sensors.
  - 2. Lighting contactors.
  - 3. Emergency shunt relays.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
  - 2. Interconnection diagrams showing field-installed wiring.
- C. Comprehensive Product Data and Shop Drawing Submittal Package: Submit product data and shop drawing information for all items specified under this Section in a single comprehensive Product Data and Shop Drawing Submittal Package. Submittals that do not include each specified unit or contain incomplete submittal information will be rejected.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products from the following, or an approved equivalent:
  - 1. Hubbell Lighting.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
  - 1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
  - 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  - 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
  - 4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  - 6. Bypass Switch: Override the on function in case of sensor failure.
  - 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
  - 1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
  - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
  - 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
  - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  - 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
  - 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
  - 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.
  
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
  - 1. Sensitivity Adjustment: Separate for each sensing technology.
  - 2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

## 2.2 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Allen-Bradley/Rockwell Automation.
  - 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
  - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 4. GE Industrial Systems; Total Lighting Control.
  - 5. Hubbell Lighting.
  - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 7. Square D; Schneider Electric.
  - 8. TORK.
  - 9. Touch-Plate, Inc.
  - 10. Watt Stopper (The).
  
- B. Description: Electrically operated and mechanically held unless indicated otherwise, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
  - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  - 3. Enclosure: Comply with NEMA 250.
  - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

- C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
  - 1. Monitoring: On-off status.
  - 2. Control: On-off operation.

### 2.3 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Lighting Control and Design, Inc.
- B. Description: Normally-closed, electrically-held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
  - 1. Coil Rating: 120 V or as indicated.

### 2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Conductors and Cables."
- B. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Conductors and Cables."

## PART 3 - EXECUTION

### 3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### 3.2 CONTACTOR INSTALLATION

- A. Mount electrically-held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

### 3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260923

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\260923\_100CD\_LIGHTING CONTROL DEVICES.DOC

## SECTION 260943 – DIGITAL ROOM CONTROLLER (DRC) BASED LIGHTING CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Digital room controllers.
  - 2. DRC manual controls (switches and dimmers)
  - 3. DRC occupancy sensors.
  - 4. DRC photosensors.
  - 5. DRC system input/output modules.
  - 6. Emergency shunt relays.
  - 7. Building automation system (BAS) interface
  - 8. Fire alarm system (FAS) interface.
- B. Related Sections include the following:
  - 1. Division 23 Section "Instrumentation and Control for HVAC Systems." for BAS interconnection.
  - 2. Division 28 Section "Digital, Addressable Fire Alarm System" for FAS interconnection.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. Broadcast Command: A command that is received by all devices on a network.
- C. Channel: see Group.
- D. 0-10V Dimming: ANSI E1.3-2001, Entertainment Technology - Lighting Control Systems - 0 to 10V Analog Control Specification.
- E. Fade:
  - 1. Fade Override: The ability to temporarily set fade times to zero for all lighting scenes.
  - 2. Fade Rate: Adjustment steps per second.
  - 3. Fade Time: The time it takes to fade from one setting to another.
- F. FAS: Fire alarm system.
- G. FC: Foot-candle.
- H. Group: One or more luminaries controlled together as a single unit.
- I. LAN: Local Area Network.



- J. LCS: DRC-based Lighting Control System.
- K. LED: Light-Emitting Diode
- L. LCN: Lighting Control Network, a digital communications network that ties individual digital room controllers and other DCR-based lighting control system components together. LCN includes all networking components, wiring, raceways and software required to establish features and functionality specified.
- M. LCSP: Lighting Control System Provider; a single contracting entity and systems integrator providing the DRC-based lighting control system, system warranty and support.
- N. NRTL: Nationally Recognized Testing Laboratory.
- O. PC: Personal Computer using IBM protocols and Microsoft operating system.
- P. PIR: Passive Infrared.
- Q. RCP: Reflected Ceiling Plan
- R. Scene: A lighting state, effect, and/or script.
- S. SOO: Sequence of Operations. Method, process, or procedure for accomplishing a given function or task.
- T. SPD: Surge Protective Device.
- U. Zone: See Group.

#### 1.4 SUBMITTALS

- A. General: Submittals shall be in searchable PDF electronic format.
- B. Product Data: List of components for lighting control system, including dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. Include a complete Bill of Materials for each type of product as applicable to include:
  - 1. User controls, gateways, and other controls and controllers to include dimensions, features, and ratings in accordance with the SOO.
  - 2. Device covers plates, color, and material.
  - 3. Operational documentation for software and firmware.
  - 4. Driver, Ballasts and lamp combinations compatible with dimmer controls.
  - 5. Control wire and connectors.
  - 6. Control wire and cable to include color and insulation type.
- C. Delegated Design: The DRC-based lighting controls manufacturer shall design the occupancy sensor and photo sensor layouts to provide a complete volumetric coverage of the spaces in which they are located. Provide proper number of sensors and associated power packs as required to provide full coverage.
- D. Shop Drawings: Provide a complete set of detailed installation drawings specific to this project that include assemblies, schedules, and details as required to fully define the installation, testing, startup, and other elements necessary to create a complete DRC-based lighting control system in accordance with these construction documents to include:

1. Equipment Outline Drawings: Indicate dimensions, weights, arrangement of components, clearance and access requirements.
  2. Floor Plans: Location, orientation, and coverage area of each sensor, group designations, and other specific design symbols and designations as required to define the installation, location, and configuration of the specific control devices being provided under this contract.
  3. System Riser Diagram: Show connections between components specified in this Section and devices furnished under other Sections. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines. Diagram shall be specifically drawn for this project and directly applicable thereto. Generic diagrams are not acceptable.
  4. Daylighting show optimal placement of photo sensor and the proportional relationship between measured light at photo sensor and area(s) being controlled by that light level.
  5. Sample screen shots of monitoring and control software.
- E. Comprehensive Product Data and Shop Drawing Submittal Package: Submit product data and shop drawing information for all items specified under this Section in a single comprehensive Product Data and Shop Drawing Submittal Package. Submittals that do not include each specified unit or contain incomplete submittal information will be rejected.
- F. Manuals and Documentation.
- G. Field quality-control test reports.
- H. Maintenance Data: For DRC-based lighting control system equipment components to include in emergency, operation and maintenance manuals.

#### 1.5 MANUALS AND DOCUMENTATION

- A. Software and Firmware Operational Documentation: Software operating and upgrade manuals.
- B. Record Documents: Drawings showing the actual installed hardware and configuration to include: power circuits, control device identification, schedules of control functions, and controls, and sensors.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements to include:
1. Event log verifying the performance of all devices generating event messages to include occupancy sensors, control buttons, alarm messages, and any other messages.
  2. Trend data for all daylight zones covering a period of not less than one week and demonstrating performance consistent with the submitted computer models for those spaces.
  3. Trend or event data demonstrating compliance to the occupancy management sequence of operation for all zones or a minimum of three zones randomly chosen by Owner. Data shall include one week of trend data at five minutes intervals for each selected zone to include photo sensor reading, occupancy state, daylight setting, user light setting, and energy use.
  4. Submit reports via pdf electronic files, with supporting data provided as xls files.
  5. Additional documentation for other systems as required demonstrating compliance with the written sequence of operations.
- D. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following Software manuals.
1. Adjustments of scene preset controls, fade rates, and fade overrides.
  2. Operation of adjustable zone controls.

3. Testing and adjusting of emergency lighting and night lighting features.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitation: The LCSP shall provide all DRC-based lighting control components and final commissioning. DRC-based lighting control components shall be by a single vendor.
- B. Lighting control components shall include all operating elements of the lighting control system to include: 0-10V controlled fixtures, occupancy sensors, wall controls, photo sensors, routers, gateways, servers, software, and other devices and software that are an integral part of the lighting control system.
- C. LCSP Qualifications: A firm experienced in sourcing a complete and integrated package of control equipment similar to that indicated for this Project and with a minimum five year record of successful in-service performance on similar projects.
- D. Installer Qualifications: An installer who is trained and recognized by the LCSP in both installation and maintenance of units required for this Project.
- E. Startup Personnel Qualifications: The Installer shall engage specially trained personnel who are directly employed by the LCSP to perform final start-up, configuration, and system testing.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- G. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- H. Comply with NFPA 70.
- I. Comply with State and Local energy and electrical codes.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate lighting control components to form an integrated interconnection of compatible components.
  1. Match components and interconnections for optimum performance of lighting control functions.
  2. Provide all components required to facilitate the described sequences of operations.
- C. Coordinate lighting control components specified in this Section with components specified in other Sections, including the following:
  1. Division 26 Section "Lighting."

#### 1.8 WARRANTY

- A. Materials Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:

- a. Software: Failure of input/output to execute switching or dimming commands.
  - b. Failure of modular relays to operate under manual or software commands.
  - c. Damage of electronic components due to transient voltage surges.
2. Warranty Period: Five years for control components from date of building occupancy.
  3. Coverage: Cost to repair or replace malfunctioning parts including labor and excluding consequential damages.
- B. Installation Warranty: Installer shall make timely repairs of problems arising from workmanship, construction document compliance, and defective or failed components.
1. Warranty Period: One year from date of substantial completion.
  2. Cost: Labor and materials
- C. On-line Limited System Warranty and Support (Single Point of Responsibility)
1. LCSP shall provide a full system warranty covering the operation of all components provided under this specification and in accordance with construction documents, sequence of operation, and manufacturer's requirements.
  2. On-line System Warranty Period: Two years from date of substantial completion. Coverage shall be 24 Hours Per Day, 7 Days Per Week Telephone Technical Support, Excluding Manufacturer Holiday
  3. Coverage to include:
    - a. Assist Owner's designated maintenance person to identify and correct problems in accordance with standard warranty.
    - b. Assistance to Owner in operation and configuration of the system.
- D. System Access: Owner to provide VPN or equivalent high-speed secure Internet connection to the lighting control domain for duration of the warranty and system support period.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. System Management Software Updates: Two year
  2. Control Module (Gateway): One of each type installed.
  3. Communication Bridge: One for every 10 of each type installed. Furnish at least one of each type
  4. Wall Switches and Dimmers: Equal to two percent of each type installed, but no fewer than twenty.
  5. Graphic Wall Stations: Equal to two percent of each type installed, but no less than one if at least one is provided as part of the Work.
  6. Scene Controllers: Equal to two percent of each type installed, but no less than one if at least one is provided as part of Work.
  7. Occupancy Sensors Equal to two percent of each type installed, but no fewer than twenty.
  8. Daylight Photosensors: Equal to two percent of each type installed, but no fewer than ten.
  9. Power (Relay) Packs: Equal to two percent of each type installed, but no fewer than twenty.
  10. Auxiliary Input/Output Devices: Equal to two percent of each type installed, but no fewer than two.

#### 1.10 LCSP SERVICES

- A. Provide engineering assistance as needed during delivery and installation to assist Installing Contractor.
- B. A qualified factory authorized technician or qualified agent shall provide a sufficient level of inspection prior to energizing the system to assure with a high level of confidence that passive and active lighting system components have been provided and installed in accordance with the contract documents and manufacturer's recommendations whichever is more stringent. Inspections shall include: lighting fixtures, drivers, lamps, ballasts, fixtures wiring, grounding, network wire, connectors, connections, labeling, enclosures, and general workmanship. Printed inspection sheets for a minimum of five of each fixture type and other system elements shall be created, filled in, dated, initialed, and included in the system O&M manual.
- C. A qualified factory authorized technician shall supervise initial turn-on and shall cooperate with the installing Contractor in making any required adjustment or trimming of components to enable the system to function as specified.
- D. As a portion of the final inspection, the technical will demonstrate the system in the presence of the Design Professional, Owner and/or Controls Consultant, as directed, to prove that the system is operating properly as well as providing instruction in the use and Owner's maintenance of the system.
- E. Provide a minimum of four hour sessions (16 hours total) of formal operation and maintenance instruction separate from the demonstration and offered at the convenience of the Owner's schedule in the presence of the Controls Consultant.
- F. Provide a minimum of 40 hours of formal demonstration of the system operation to the commissioning agent. Refer to Division 1 and Part 3 of this specification for extent of scope.

#### 1.11 LIGHTING CONTROL CLOSEOUT SERVICES

- A. The LCSP shall provide an allowance of a minimum of 40 hours of additional programming and configuration with the Lighting Designer, Controls Consultant, and Owner by a qualified factory authorized technician after substantial completion.

### PART 2 - PRODUCTS

#### 2.1 DRC-BASED LIGHTING CONTROL SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide from the following systems, or an approved equivalent:
  - 1. Hubbell NX.
- B. Description: Digital room controller based lighting controls with the following features:
  - 1. Manual, time-based and sensor-based (occupancy and daylight) lighting control.
  - 2. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed). Specific dimmers will be capable of "dimming lights to off"
  - 3. System devices shall be networked together, enabling digital communication between devices, and shall be individually addressed.
  - 4. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity, even if network connectivity to the system network is lost.

5. The system architecture shall facilitate remote operation via a computer connection.
6. The system shall not require any centrally hardwired switching equipment.
7. Fully wired architecture, wireless devices are unacceptable.

## 2.2 SYSTEM OVERVIEW

- A. Provide a complete and operational 0-10V lighting control system designed for the control of general purpose and architectural lighting.
- B. The system architecture shall use peer-to-peer communication and distributed logic to provide real-time operation and operational security where the failure of any single component or node shall be locally isolated and not cause the loss of global system functions.
- C. Each Lighting Control Network shall use the LCSP recommended data transmission cable or wire installed per the manufacturer's recommendation.
- D. Provide power boosters as required to maintain network integrity.
- E. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
- F. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photosensor sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
- G. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see Networked LED Luminaire section).
- H. Intelligent lighting control devices shall communicate digitally, require less than 7 mA of current to function (graphic wall stations excluded), and possess RJ-45 style connectors.
- I. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
- J. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
- K. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
- L. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- M. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, controls enabled luminaires, or from the network backbone. Standalone "bus power supplies" shall not be required.
- N. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

- O. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.
- P. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.
- Q. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control schedules and profiles.
- R. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photosensor, and switch functionality for more advanced configurations and sequences of operation.
- S. Devices located in different lighting zones shall be able to communicate occupancy, photosensor (non-dimming), and switch information via the wired backbone.
- T. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day and day-of-week utilization of a space.
- U. Expansion Capability: Adequate to increase the number of control functions in the future by 20 percent. This expansion capability applies as applicable to equipment ratings, housing volumes, spare relays, terminals, number of conductors in control cables, device connected load, and control software.
- V. Line-Voltage Surge Suppression: Factory installed as an integral part of 120vac and 277vac, solid-state control panels and control components or field-mounted surge suppressors that comply with UL 1449 and with IEEE C62.41 for Category A locations.

### 2.3 LIGHTING CONTROL SEQUENCE OF OPERATION

- A. Refer to Lighting Control Schedule on Drawings for operation and sequences.

### 2.4 LIGHTING CONTROL PROFILES

- A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
- B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
- C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
- D. Specific device parameters (e.g. sensor time delay and photosensor set-point) shall be configurable via a lighting control profile.
- E. All lighting control profiles shall be stored on the network control gateway device, with a system backup on the software’s host server.
- F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.

- G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
- H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
- I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
- J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

## 2.5 MANAGEMENT SOFTWARE

- A. Every device parameter (e.g. sensor time delay and photosensor set-point) shall be available and configurable remotely from the software
- B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current individual detection statuses, remaining occupancy time delay(s), current photosensor reading, current photosensor inhibiting state, photosensor transitions time remaining, current dim level, device temperature, and device relay state(s).
- C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
- D. A printable network inventory report shall be available via the software.
- E. A printable report detailing all system profiles shall be available via the software.
- F. Software shall require all users to login with a User Name and Password.
- G. Software shall provide at least three permission levels for users.
- H. All sensitive stored information and privileged communication by the software shall be encrypted.
- I. All device firmware and system software updates must be available for automatic download and installation via the internet.
- J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

## 2.6 BAS COMPATIBILITY

- A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software. In addition, BAS connectivity shall be via hardwire components.
- B. BACnet IP hardware shall be capable of supporting up to 1500 total devices across up to 5 total Gateways
- C. BACnet IP connection shall communicate information gathered by networked system to other building management systems.
- D. BACnet IP connection shall translate and forward lighting relay and other select control commands from BAS to networked control devices via profiles stored in the system Gateway. All system devices shall be available for polling for devices status.



2.7 SYSTEM ENERGY ANALYSIS

- A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.
- B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.
- C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO2.
- D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photosensors, manual switching, etc).
- E. Energy savings data shall be calculated for the system as a whole or for individual zones.
- F. A time scaled graph showing all relay transitions shall be presented.
- G. A time scaled graph showing a zones occupancy time delay shall be presented
- H. A time scaled graph showing the total light level shall be presented.
- I. User shall be able to customize the baseline run-time hours for a space.
- J. User shall be able to customize up to four time-of-day billing rates and schedules.
- K. Data shall be made available via a .CSV file

2.8 CONTROL MODULE (GATEWAY)

- A. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet network.
- B. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
- C. Control device shall have three RJ-45 ports for connection to the graphic touch screen, other backbone devices bridges) or directly to lighting control devices (up to 128 per port).
- D. Device shall automatically detect all devices downstream of it.
- E. Device shall have a standard and astronomical internal time clock.
- F. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
- G. Device shall have a USB port
- H. Each control gateway device shall be capable of linking 1500 devices to the management software, with reduced memory version capable of support up to 400 devices.
- I. Device shall be capable of using a dedicated static or DHCP assigned IP address.

## 2.9 COMMUNICATION BRIDGE

- A. Device shall surface mount to a standard 4" x 4" square junction box.
- B. Device shall have 8 RJ-45 ports.
- C. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
- D. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
- E. Device shall be capable of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

## 2.10 WALL SWITCHES AND DIMMERS

- A. Devices shall recess into single-gang switch box and fit a standard GFI opening.
- B. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- C. All devices shall have two RJ-45 ports.
- D. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
- E. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
- F. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
- G. Devices with mechanical push-buttons shall be made available with custom button labeling
- H. Devices with a single "on" button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

## 2.11 GRAPHIC WALL STATIONS

- A. Device shall have a 3.5" full color touch screen for selecting up to 16 programmable lighting control preset scenes or acting as up to 16 on/off/dim control switches.
- B. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
- C. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
- D. Device shall enable user supplied .jpg screen saver image to be uploaded.
- E. Device shall surface mount to single-gang switch box.
- F. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.

- G. Device shall have a micro-USB style connector for local computer connectivity.
- H. Device shall have two RJ-45 ports for communication

## 2.12 SCENE CONTROLLERS

- A. Device shall have two, three, four, or eight buttons for selecting programmable lighting control profiles or acting as on/off switches.
- B. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
- C. Device shall recess into single-gang switch box and fit a standard GFI opening.
- D. Devices shall provide LED user feedback.
- E. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- F. All devices shall have two RJ-45 ports.
- G. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
- H. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
- I. Device shall have LEDs indicating current selection.

## 2.13 OCCUPANCY SENSORS

- A. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
- B. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies, if deemed necessary by the lighting control vendor, shall also be acceptable.
- C. Sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
- D. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
- E. Sensors shall be available in multiple lens options which are customized for specific applications.
- F. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- G. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
- H. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue

- I. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
- J. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
- K. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
- L. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation

#### 2.14 DAYLIGHT PHOTOSENSORS

- A. Photosensors shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photosensor to prevent rapid response to passing clouds.
- B. Photosensor set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
- C. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
- D. Photosensor shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
- E. A dual zone option shall be available for On/Off Photosensor, Automatic Dimming Control Photosensor, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.

#### 2.15 POWER (RELAY) PACKS

- A. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
- B. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
- C. All devices shall have two RJ-45 ports.
- D. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
- E. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment

automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

- F. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- G. Power Packs (Secondary) shall be available that provide up to 16 Amp switching of all lighting load types.
- H. Power Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or LED drivers.
- I. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC lighting loads or 120/277 VAC line voltage dimmable ballasts (2-wire and 3-wire versions).
- J. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
- K. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
- L. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
- M. Specific Secondary Packs shall be available that control louver/damper motors for skylights.
- N. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
- O. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.

## 2.16 AUXILIARY INPUT/OUTPUT DEVICES

- A. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a 1/2" knockout.
- B. Devices shall have two RJ-45 ports
- C. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
- D. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.
- E. Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
- F. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (toggle the lighting load) or run a local/remote control profile.
- G. Specific I/O devices shall sense state of low voltage outdoor photocells and photosensors.

- H. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
- I. Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).

#### 2.17 DIMMING BALLAST, DRIVERS AND SWITCHING MODULES

- A. Refer to Division 26 Section "Lighting".
- B. The lighting control system shall be fully compatible with the light fixture drivers, ballasts and switching modules.

#### 2.18 LIGHTING NETWORK CONDUCTORS AND CABLES

- A. General:
  - 1. Low-voltage Lighting Control Network wire shall meet the requirements of this specification, the local jurisdiction, or LCSP recommendations, whichever is more stringent.
  - 2. Unless stated otherwise on construction drawings, a Control Network wire pair shall be pulled with each lighting power circuit servicing the 0-10V lighting controls, #16 AWG, stranded copper with THHN insulation or as required to be consistent with NEC Paragraph 300-3(c)(1).
  - 3. Network wire between fixtures shall be Class 2 in accordance with NEC Article 725 and allowed by local jurisdiction. Network wire shall be stranded copper cable, plenum rated with yellow jacket and a minimum size of 18 AWG.
- B. Connectors, Splices, and Taps:
  - 1. High quality gas-tight insulation displacement, wire trap or similar connectors suitable for low voltage, low power, shall be used to splice all Class 1 and Class 2 control wiring.
  - 2. Twist-on wire-nut type connectors are not allowed unless specifically submitted and approved for digital network applications.

#### 2.19 ETHERNET LAN

- A. Provide a building LAN receptacle located at the main system hub. Coordinate work with communications sub-contractor and Owner.
- B. Provide and install patch cables and Ethernet switch hubs in compliance with building LAN requirements and as needed to connect the Lighting System Network to Ethernet LAN.
- C. Provide a TCP/IP modem capable of maintaining a secure Internet connection using VPN or equivalent protocol acceptable to Owner.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of LCS.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of DRC-based lighting controls.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Examine rough-in for lighting control system to verify actual locations of conduit connections before equipment installation.
- C. Examine walls, floors, ceiling, and roofs for suitable conditions where components will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install equipment level, plumb, and at right angles to building in a neat and workmanlike manner.
- B. Anchor to building structural elements and support according to requirements in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Label all wire and enclosures in accordance with Division 26 "Electrical Identification".

### 3.3 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage of controlled areas per the manufacturer's recommendations. Room shall have 95 to 100 percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- C. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the building, to verify placement of sensors and installation criteria.
- D. Proper judgement must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

### 3.4 WIRING INSTALLATION

#### A. General:

1. Comply with manufacturer's written instructions for wiring installation or this spec whichever is more stringent.
2. All wiring to wall mounted devices in exposed locations shall be installed in EMT.
3. Conductors to Class 2 occupancy sensors, photo-sensors and wall stations shall be installed in EMT, flexible metal conduit or free run cable in accordance with NEC Article 725 for Class 2 circuits.
4. Secure and support cables at intervals not exceeding 5 feet. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
5. Cable supports shall use double wire ties or equivalent methods that prevent direct contact between the cable and sharp and /or hard surfaces such as running thread rods, pipe supports and suspended ceiling wires.
6. Cable supports shall be independent of other systems. Cables shall not be secured to ceiling support wires, mechanical ducts or piping or draped across ceilings.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
8. Install conductors parallel with walls, a structural members at right angles t.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable
10. In the ceiling above the work area wall station, install a 6 foot long cable service loop.
11. In the ceiling at sensors cable shall include at least 6 feet of coiled cable to allow tiles to be relocated.
12. Pulling Cable: Comply with BICSI ITSIM, monitor cable pull tensions.

#### B. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.



5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
  6. Separation between Communications Cables and Fixtures: A minimum of 5 inches
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to equipment manufacturer's written instructions.
  - D. Install field-mounted transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
  - E. Equipment Grounding: Provide low-impedance "hard" copper earth grounding to drivers, ballasts, fixtures, and control mounting boxes in accordance with driver, ballast, lamp, and control manufacturer's requirements. Floating fixture strike plates and high-impedance "safety grounds" are generally not acceptable and standard UL listed safety grounds may not be sufficient.
  - F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 IDENTIFICATION

- A. Identify components, and power and control wiring in accordance with Division 26 Section "Electrical Identification."
- B. Identify all ceiling mounted controls in blank covered boxes with type of control located in box.
- C. Label each wiring pair within six inches of connection to control network bus supply or termination block. Each control wire pair shall be labeled in accordance with Division 26 Identification section and shall include the electrical power panel name and circuit number with which the wire pair is pulled.

### 3.6 FIELD QUALITY CONTROL AND INITIAL START-UP

- A. At the time of checkout and testing, the Owner's Representative shall be thoroughly instructed in the proper operation of the system. Provide at least two weeks notification to Owner prior to testing
- B. Complete installation and startup checks in accordance with manufacturer's written instructions to include the following:
  1. Pre-function:
    - a. Compliance inspection of all materials, controls, and light fixtures
    - b. Activate light fixtures and verify that all fixtures are operating at 100%
    - c. Burn-in fixtures at 100% for 100 hours or per manufacturer's recommendations
    - d. Test that control wiring is free of wire-ground and wire-wire shorts and ac line voltage before connecting to the Bus Supply.
    - e. Perform initial configuration as required by manufacturer to verify proper connection and basic operation of all components.
  2. Perform the following field tests and inspections and prepare test reports:
    - a. Complete installation and start-up checks according to manufacturer's written instructions.
    - b. Test for circuit continuity, open, shorts and other tests recommended by the manufacturer.
    - c. Check operation of local control devices.
    - d. Verify that the control system features are operational.

- e. Test system diagnostics by simulating improper operation of several components selected by Owner/Design Professional.
  - f. After installing sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - g. Operational Test: Verify actuation of each sensor and adjust time delays.
  - h. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform Continuity tests of circuits according to manufacturer's written instructions:
  - i. Operational Tests: Set and operate controls at PC workstations and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by the manufacturer. Note response to each test command and operation
  - j. Verify normal operation of each fixture after installation.
  - k. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to backup source and retransfer to normal.
- C. Track testing and functional performance of the system by filling in the following Lighting Control Functional Test Form:

## LIGHTING CONTROL FUNCTIONAL TEST FORM

Area: \_\_\_\_\_ Date: \_\_\_\_\_ Ref. DWG: \_\_\_\_\_

Function/Mode	Test Method	Pass	Fail	Sign Off			
				EC	MR	CM	CA
Miscellaneous functions.							
All specified functions and features are set up, debugged and fully operable..	Verbal discussion of features.						
Power failure and battery backup and power-up restart functions	Demonstration						
Security and access codes	Demonstration						
Scheduling features fully functional and setup, including holidays.	Observation at computer and via printouts.						
Date and time setting in central computer and verify that field panels read the same.	Demonstration						
Sweep Function							
All of the zones must be verified by turning on at least 25% of the lights in the zone and witnessing an actual sweep off.	Demonstration						
Dimming Functions							
All of the dimmers must be verified by turning on the lights in each area or room and selecting multiple scenes, witnessing an actual change in the lighting levels.	Demonstration						
Verify that delays and ramp times are set and functional so that the speed of change of light fixture output is slow enough to be judged non-bothersome to occupants.	Demonstration						
Verify that the controls and sensors are not easily overridden or disabled by occupants.	Demonstration						
Verify that the occupancy sensor in meeting rooms turns lights off when room is unoccupied for 15 minutes.	Demonstration						
Occupancy Sensor Functions							
Each area with an occupancy sensor shall be monitored to confirm operation of the sensor.	Demonstration						
Miscellaneous							
Verify that the interface to the building computer system is operational.	Demonstration						

Items that do not apply shall be noted with the reasons on this form (N/A = Not applicable, BO = By Others). EC = Electrical Contractor, MR = Manufacturers Representative, CM = Construction Manager, CA = Commissioning Agent.

- D. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- E. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- F. Reports: Prepare written reports of tests, inspections, verifications and observations indicating and interpreting results. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- H. Verify normal operation of each fixture after installation.
- I. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to backup source and retransfer to normal.
- J. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- K. Internet Connection: Provide a high-speed Internet or equivalent communication connection as required by the LCSP for use during system start-up.

### 3.7 LCSP FIELD SERVICE

- A. Engage a factory-authorized service technician to perform final system configuration and verification to include the following:
  - 1. Verify system compliance and operation in accordance with the design documents
  - 2. Test system diagnostics by simulating improper operation of several components selected by Architect.
  - 3. Test and configure sensors and user controls with final operational settings.
  - 4. Set and operate controls at the system workstation and at monitored and controlled devices to demonstrate their functions and capabilities.
  - 5. Install, configure, and test the Lighting Management System software and graphical interface as required by the Lighting Control sequences of operation.
  - 6. Demonstrate system operation to the Design Professional and Owner as described in Part 1 of this specification.
    - a. Train the Owner's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Train them in troubleshooting, servicing, adjusting, and maintaining equipment.
  - 7. Provide close-out support per Part 1 of this specification.
  - 8. Use the approved final versions of software and maintenance manuals as training aids.
- B. Commissioning Support:
  - 1. Provide support to commissioning process as described in Part 1 of this specification.
  - 2. The LCS shall be commissioned on a floor by floor basis and then finally as an entire system.
  - 3. Final Acceptance of the LCS shall be contingent upon successful commissioning of each floor and the entire system.

4. As the LCS installation is completed on individual floors by the Electrical Installation Contractor, a partial system start up, testing and commissioning plan shall be implemented by the LCS Supplier factory-trained engineer(s).
5. Upon completion of the entire LCS installation by the Electrical Installation Contractor, the system shall then be commissioned by the LCS Supplier as a whole system. The commissioning will be performed upon notification by the Electrical Installation Contractor that the system installation is complete and that all loads have been tested live for continuity and freedom from defects and that all control wiring has been connected and checked for proper continuity. The LCS Supplier shall perform supervisory functions during the Electrical Installation Contractor final checkout.
6. The LCS Supplier shall provide the Owner, Architect and Engineer with ten working days advance notice of the scheduled final commissioning start date.
7. Upon completion of the final system checkout, the LCS Supplier shall demonstrate the functionality of the LCS to the Owner.
8. The LCS Supplier shall demonstrate the operation of the LCS to the Owner. Each lighting sequence shall be fully demonstrated to be in accordance with the Specification.
9. The LCS Supplier shall demonstrate the reliability of the LCS to the Owner. Compliance with the Specification shall be demonstrated over a 30 day test period.
10. The LCS Supplier shall demonstrate the flexibility of the LCS to the Owner. Rezoning of daylight zones and independent zones shall be demonstrated solely with the use of the PC/console. No physical wiring may be moved, added or removed during these demonstrations.
11. The LCS Supplier shall demonstrate the self diagnostics and self-corrective features of the LCS to the Owner.
12. The LCS Supplier shall demonstrate the emergency lighting and night-light features of the LCS to the Owner. A power outage shall be scheduled during this part of the commissioning program.
13. The LCS Supplier shall demonstrate the occupancy zone integrity of the LCS to the Owner.
14. The LCS Supplier shall demonstrate full reporting capabilities and system refresh rate of 30 seconds or less.
15. During commissioning the following shall be measured to determine system performance:
  - a. Work plane illuminance for various target set points in the open plan areas at any work stations in the daylighting zones as selected by Owner
  - b. Luminance at the interior of the perimeter window wall
  - c. Lighting system energy usage
16. The LCS Supplier shall correlate daylight dimming with natural light levels.
17. System must be demonstrated to perform 90% of the time in accordance with work plane illuminance targets under daylight conditions over a 30 day test period.

### 3.8 OFF-SITE TECHNICAL SUPPORT

- A. Hardware and Software: Within Two year of the date of Substantial Completion, provide unlimited response to general user questions regarding software and hardware use and operation.
  1. Availability: Eight hours per day, weekdays during normal business hours.
  2. Responder Qualifications: Engineer or technician thoroughly familiar with the Lighting Control System.
- B. Make available to the Owner a support plan to provide off or on-site support for the specific system to include troubleshooting, control, monitoring, and additional training and configuration of the system as requested by the Owner.
- C. Internet or equivalent communication channel as required by LCSP shall be provided by Owner.

3.9 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to six visits to Project during other-than-normal occupancy hours for this purpose.

3.10 POST OCCUPANCY EVALUATION

- A. Post Occupancy Evaluation report one year after Final Acceptance this is for mutual benefit of the Owner and LCSP Supplier to ensure the lighting control system is operating according to the original design intent.
  - 1. Analysis of the lighting energy usage
  - 2. Analysis of the integrity of the zones
  - 3. Analysis of target set points compliance
  - 4. Analysis of lighting sequences and their application in the various spaces
  - 5. Status of emergency lighting

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_Cafe\_IFC\260943\_100cd\_drc-based lighting controls.doc

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Straight-blade receptacles
  - 2. GFCI receptacles.
  - 3. Twist-locking receptacles.
  - 4. Snap switches.
  - 5. Digital timer switches.
  - 6. Wall-box dimmers.
  - 7. Solid-state fan speed controls.
  - 8. Wall plates.
  - 9. Multi-outlet assemblies.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Comprehensive Product Data and Shop Drawing Submittal Package: Submit product data and shop drawing information for all items specified under this Section in a single comprehensive Product Data and Shop Drawing Submittal Package. Submittals that do not include each specified unit or contains incomplete submittal information will be rejected.

- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
- B. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. GFCI Receptacles: One for every 10 of each type installed, but no fewer than two of each type.
  - 2. SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

#### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Construction Specification Grade, Duplex Convenience Receptacles, 125 V, 20 A, Back and Side Wired: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour, CRB5362 Series or comparable product by Cooper, Hubbell, Leviton or equivalent.
- B. Specification Grade Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.



1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour, TR63 Series or comparable product by Cooper, Hubbell, Leviton or equivalent.

## 2.3 GFCI RECEPTACLES

- A. General Description: Specification Grade Straight blade, feed-through or non-feed-through type, depending on application. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour, 2097 Series or comparable product by Cooper, Hubbell, Leviton or equivalent.
- C. Tamper Resistant duplex GFCI Convenience Receptacles, 125 V, 20 A:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour, 2097TR Series or comparable product by Cooper, Hubbell, Leviton or equivalent.

## 2.4 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour, L5-20R Series or comparable product by Cooper, Hubbell, Leviton or equivalent.

## 2.5 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Hard Use Commercial Specification Grade Switches, 120/277 V, 20 A:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Pass & Seymour, CSB20AC1 Series or comparable product by Cooper, Hubbell, Leviton or equivalent.

## 2.6 DIGITAL TIMER LIGHT SWITCH

- A. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with adjustable time-out interval from 5 minutes to 12 hours. Refer to Drawings for additional requirements.

## 2.7 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.

## 2.8 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
  - 1. Continuously adjustable rotary knob, 5 A.
  - 2. Three-speed adjustable rotary knob, 1.5 A.

## 2.9 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel.
    - a. Receptacle faceplates for laboratory and vivarium areas, including corridors, equipment alcoves, procedure rooms and lab/vivarium storage areas shall have engraved designations indicating panel and circuit number with black (normal power) or red (emergency/standby)-filled lettering on face of plate.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
  - 5. Color and Finish: As selected by Architect from manufacturer's full range.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

## 2.10 MULTI-OUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.
  - 2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 12 AWG minimum.

## 2.11 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Wiring Devices Connected to Normal Power System: White or as selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Emergency Power System: Red.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  - 8. Tighten unused terminal screws on the device.
  - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left. Confirm receptacle orientation with Owner prior to installation.

- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
  - 1. Install dimmers within terms of their listing.
  - 2. Verify that dimmers used for fan speed control are listed for that application.
  - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

### 3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
  - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\262726\_100CD\_WIRING DEVICES.DOC

## SECTION 262813 - FUSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:

1. Cartridge fuses rated 600 V and less.
2. Spare-fuse cabinets.

#### 1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

- B. Comprehensive Product Data Submittal Package: Submit product data information for all items specified under this Section in a single comprehensive Product Data Submittal Package. Submittals that do not include each specified unit or contains incomplete submittal information will be rejected.

- C. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

- D. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - a. Let-through current curves for fuses with current-limiting characteristics.
  - b. Time-current curves, coordination charts and tables, and related data.
  - c. Ambient temperature adjustment information.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

#### 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### 1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 3 of each type and size.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
  - 1. Cooper Bussman, Inc.
  - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

#### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

## 2.3 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay.
- B. Feeders (greater than 600A): Class L, time delay.
- C. Feeders (600A or less): Class RK1, time delay.
- D. Motor Branch Circuits: Class RK1, time delay.
- E. Other Branch Circuits: Class J, time delay.

### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinets in each main electrical room and in other locations as indicated.

### 3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\262813\_100CD\_FUSES.DOCX



## SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Non-fusible switches.
  - 3. Molded-case circuit breakers.
  - 4. Molded-case switches.
  - 5. Enclosures.

#### 1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. RMS: Root mean square.
- D. NC: Normally closed.
- E. NO: Normally open.
- F. SPDT: Single pole, double throw.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For each type of enclosed switch and circuit breaker. Include plans, elevations, sections and details.

1. Wiring Diagrams: For power, signal, and control wiring.
- C. Comprehensive Product Data and Shop Drawing Submittal Package: Submit product data and shop drawing information for all items specified under this Section in a single comprehensive Product Data and Shop Drawing Submittal Package. Submittals that do not include each specified unit or contains incomplete submittal information will be rejected.
- D. Field quality-control reports.
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: One for each size and type.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or equivalent:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
  - 1. Short-Circuit Current Rating: 200kA when equipped with J, L or R fuses
- C. Non-fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
  - 1. Short-Circuit Current Rating: 200kA when protected by upstream J, L or R fuses.
- D. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contacts, arranged to activate before switch blades open.
  - 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

### 2.2 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or equivalent:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.

- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. 400A frame or Smaller: Thermal-magnetic circuit breaker; inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Larger than 400A frame: Electronic trip circuit breaker; field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- E. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  - 7. Accessory Control Power Voltage: Integrally mounted, self-powered.

### 2.3 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or equivalent:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Molded-case circuit breaker type with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
  - 1. Standard frame sizes and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 4. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.

## 2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 3. Outdoor Locations: NEMA 250, Type 3R.
  - 4. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

### 3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.

### 3.4 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- C. Tests and Inspections:
  1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.

### 3.7 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\262816\_100CD\_ENCLOSURED SWITCHES AND CIRCUIT BREAKERS.DOC

## SECTION 262913 - ENCLOSED CONTROLLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
  - 1. Full-voltage manual.
  - 2. Full-voltage magnetic.
  - 3. Multi-speed.
  - 4. Reduced-voltage solid state.
- B. Related Section:
  - 1. Division 26 Section "Variable-Frequency Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

#### 1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
  - 1. Show tabulations of the following:

- a. Each installed unit's type and details.
  - b. Factory-installed devices.
  - c. Nameplate legends.
  - d. Short-circuit current rating of integrated unit.
  - e. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
2. Wiring Diagrams: For power, signal, and control wiring.
- C. Comprehensive Product Data and Shop Drawing Submittal Package: Submit product data and shop drawing information for all items specified under this Section in a single comprehensive Product Data and Shop Drawing Submittal Package. Submittals that do not include each specified unit or contains incomplete submittal information will be rejected.
- D. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around enclosed controllers where pipe and ducts are prohibited. Show enclosed controller layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Routine maintenance requirements for enclosed controllers and installed components.
  2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
  3. Manufacturer's written instructions for setting field-adjustable overload relays.
  4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
- G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- 1.5 QUALITY ASSURANCE
- A. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.



1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

1.8 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
  - 1. Do not install enclosed controllers below wet piped systems. If unavoidable, install protective shields to deflect leaks away from enclosed controller.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  - 3. Indicating Lights: Two of each type and color installed.
  - 4. Auxiliary Contacts: Furnish one spares for each size and type of magnetic controller installed.
  - 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equivalent:
1. Eaton Corporation; Cutler-Hammer Products.
  2. General Electrical Company; GE Industrial Systems.
  3. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
  4. Siemens Energy & Automation, Inc.
  5. Square D; a brand of Schneider Electric.

### 2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."
1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
- B. Magnetic Controller: NEMA ICS 2, Class A, full-voltage, non-reversing, across-the-line, unless otherwise indicated.
1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
  2. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 20 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
- C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.

### 2.3 MULTI-SPEED ENCLOSED CONTROLLERS

- A. Multi-speed Enclosed Controller: Match controller to motor type, application, and number of speeds; include the following accessories:
1. Compelling relay to ensure that motor will start only at low speed.
  2. Accelerating relay to ensure properly timed acceleration through speeds lower than that selected.
  3. Decelerating relay to ensure automatically timed deceleration through each speed.

## 2.4 REDUCED-VOLTAGE SOLID-STATE CONTROLLERS

- A. General Requirements for Reduced-Voltage Solid-State Controllers: Comply with UL 508.
- B. Reduced-Voltage Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, poly-phase, medium induction motors.
  - 1. Configuration: Standard duty; nonreversible.
  - 2. Starting Mode: Voltage ramping, current limit, torque control, and torque control with voltage boost; field selectable.
  - 3. Stopping Mode: Coast to stop, adjustable torque deceleration, and adjustable braking; field selectable.
  - 4. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
  - 5. Shorting and Input Isolation Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors.
  - 6. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
  - 7. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
    - a. CPT Spare Capacity: 100 VA.
  - 8. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
  - 9. SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration without external feedback from the motor or driven equipment.
  - 10. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
    - a. Adjusting motor full-load amperes, as a percentage of the controller's rating.
    - b. Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
    - c. Adjusting linear acceleration and deceleration ramps, in seconds.
    - d. Initial torque, as a percentage of the nominal motor torque.
    - e. Adjusting torque limit, as a percentage of the nominal motor torque.
    - f. Adjusting maximum start time, in seconds.
    - g. Adjusting voltage boost, as a percentage of the nominal supply voltage.
    - h. Selecting stopping mode, and adjusting parameters.
    - i. Selecting motor thermal overload protection class between 5 and 30.
    - j. Activating and de-activating protection modes.
    - k. Selecting or activating communication modes.
  - 11. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
    - a. Controller Condition: Ready, starting, running, stopping.
    - b. Motor Condition: Amperes, voltage, power factor, power, and thermal state.
    - c. Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor under-load, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.

12. Controller Diagnostics and Protection:

- a. Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller over-temperature and motor-overload alarm and trip; settings selectable via the keypad.
- b. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and under-load conditions; and line frequency over or under normal.
- c. Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component or when the motor is stopped.
- d. Shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.

13. Remote Output Features:

- a. All outputs prewired to terminal blocks.
- b. Form C status contacts that change state when controller is running.
- c. Form C alarm contacts that change state when a fault condition occurs.

14. Optional Features:

- a. Analog output for field-selectable assignment of motor operating characteristics; 4 to 20-mA dc.
- b. Additional field-assignable Form C contacts, as indicated, for alarm outputs.
- c. Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
- d. Isolated overload alarm contact.
- e. External overload reset push button.

C. Combination Reduced-Voltage Solid-State Controller: Factory-assembled combination of reduced-voltage solid-state controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:

- a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate associated fuses.
- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.5 ENCLOSURES

A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.6 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
- F. Elapsed Time Meters: Heavy duty with digital readout in hours.
- G. Phase-Failure and Under-voltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable under-voltage setting.

## 2.7 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

### 3.3 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in each fusible-switch enclosed controller.

- D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

### 3.4 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved nameplate.
  - 3. Label each enclosure-mounted control and pilot device.

### 3.5 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Division 26 Section "Low-Voltage Cables and Conductors."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
  - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
  - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.6 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.8 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.

D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

E. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

### 3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\262913\_100CD\_ENCLOSED CONTROLLERS.DOC



## SECTION 265100 - INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior lighting fixtures, lamps, and ballasts, LED engines and drivers.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Lighting fixture supports.
- B. Related Sections include the following:
  - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multiple lighting relays and contactors.
  - 2. Division 26 Section "Wiring Devices" for manual wall-box dimmers.

#### 1.3 DEFINITIONS

- A. LM: Lumen Maintenance (factor): extrapolated performance projections for the platforms noted in a 25°C ambient, based on 10,000 hours LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11)
- B. CU: Coefficient of Utilization.
- C. cd: candela:
- D. CCT: Correlated color temperature.
- E. CRI: Color-rendering index.
- F. LER: Luminaire efficacy rating.
- G. RCR: Room cavity ratio.
- H. Lumen: Measured output of lamp and luminaire, or both.
- I. Mean lumens: average light output over the lamp's rated life, which reflects the gradual deterioration of performance due to the rigors of continued operation.
- J. Luminaire: Complete lighting fixture, including ballast housing if provided.
- K. SSL: solid state lighting

- L. LED: lighting emitting diodes
- M. SDCM: Standard deviation Color match.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Ballast.
  - 4. Energy-efficiency data.
  - 5. Life, output, and energy-efficiency data for lamps.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Include plans, elevation, sections, details, features, and accessories.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection
  - 2. Wiring Diagrams: Power and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Lighting fixtures.
  - 2. Suspended ceiling components.
  - 3. Structural members to which suspension systems for lighting fixtures will be attached.
  - 4. Other items in finished ceiling including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Smoke and fire detectors.
    - e. Occupancy sensors.
    - f. Access panels.
    - g. Projectors & cameras
    - h. Treatment or specialty ceiling mounted equipment

5. Perimeter moldings.
- B. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:
  1. Lamps: Specified units installed.
  2. Accessories: Cords and plugs.
  3. Pendant support system.
  4. Installation instructions
- C. Product Certificates: For each type of driver/ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- D. Qualification Data: For agencies providing photometric data for lighting fixtures.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

#### 1.6 QUALITY ASSURANCE

- A. Each Luminaire different than the one listed in the lighting fixture specification shall be provided with equal or better performance and provide photometric information for its evaluation
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- F. LED compliance with ANSI/ANSLG (ANSLG): American National Standard Lighting Group)
  1. Specifications for the Chromaticity of Solid State Lighting Products, intended to be used Indoors)
  2. Harmonic Emission Limits – Related Power Quality Requirements for Lighting Summarizes harmonic limits and methods of measurements for lighting equipment including SSL drivers and power supplies
- G. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.
  1. Obtain Architect's approval of fixtures for mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.8 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
- B. Philips Bodine (or equivalent) products shall be fully warranted for one, two, three or five year (refer to each product cutsheet). This warranty covers only properly installed Philips Bodine products used under normal conditions. For the warranty period, Philips Emergency Lighting will, at its option, repair or replace without charge a defective unit, provided it is returned to the factory transportation pre-paid and our inspection determines it to be defective under terms of warranty. Repair or replacement, as stated above, shall constitute the purchaser's exclusive warranty, which does not extend to transportation, installation, labor or any other charges; nor does it apply to any equipment of another manufacturer used in conjunction with the Philips Bodine product.
  1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
  2. Warranty Period for Emergency Ballast and Self-Powered Exit Sign Batteries: 7 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
- C. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
  1. Warranty Period for Electronic Ballasts: 5 years from date of Substantial Completion.
- D. Warranty Period for Electromagnetic Ballasts: 3 years from date of Substantial Completion.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
  2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  3. Battery and Charger Data: 1 for every 50 for each emergency lighting unit.
  4. Ballasts: 5 for every 100 of each type and rating installed. Furnish at least one of each type.
  5. Driver: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  6. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Sheet metal work shall be free of burrs, sharp corners and edges, tool marks and dents, and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true of adequate strength and structural rigidity to prevent any distortion after assembly.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- F. Lamp sockets in lighting fixtures shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fixture components. If adjustable socket positions are provided, socket should be preset in factory for lamp specified. If different socket positions are specified for same fixture, sockets shall be preset for each type, and cartons marked accordingly.
- G. Fixtures shall be completely wired at the factory.
- H. Mounting Frames and Rings: If ceiling system requires, each recessed and semi-recessed fixture shall be furnished with a mounting frame or ring compatible with the ceiling in which they are to be installed. The frames and rings shall be one piece or constructed with electrically-welded butt joints, and of sufficient size and strength to sustain the weight of the fixture.
- I. Light leaks:
  - 1. Between ceiling trims of recessed lighting equipment and the ceilings will not be approved.
  - 2. Between lighting components within the fixtures (louvers, trims, etc) will not be approved.

- J. Yokes, brackets and supplementary supporting members needed to mount lighting fixtures to carrier channels or other suitable ceiling members shall be furnished and installed by the Contractor.
- K. Adjustable Angle Fixtures: Each lighting fixture which has a beam angle adjustment shall have reliable angle locking devices.
- L. Plastic Diffusers, Covers, and Globes:
  - 1. Acrylic Lighting Diffusers: Plastic for lenses and diffusers shall be formed of colorless 100% virgin acrylic as manufactured by Rohm & Haas, Dupont or as acceptable. The quality of the raw material must exceed IES, SPI, and NEMA Specifications by at least 100% which, as a minimum standard, shall not exceed a yellowness factor of 3 after 2,000 hours of exposure in the Fade-meter or as tested by an independent test laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified, and shall remain free of any dimensional instability, discoloration embrittlement, or loss of light transmittance for at least 15 years
    - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
    - b. UV stabilized.
  - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- M. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

## 2.3 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
    - g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

3. Master/Remote Sign Configurations:
  - a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in [LED power supply for power connection to remote unit.
  - b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

## 2.4 LED LIGHTING

- A. Color temperature: shall be 3500K.
- B. CRI: LED CRI shall be minimum 82 unless otherwise noted. Manufacturer must provide all “R” values or R1 through R15.
- C. The LED system shall use 14-bit or greater nonlinear scaling techniques for high-resolution output. Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency.
- D. The LED fixture shall be operated at constant and carefully regulated current levels. LEDs shall not be overdriven beyond their specified nominal voltage and current. Data must be submitted showing and proving the measurement test point of the LED case within the fitting in situ.
- E. Thermal management: all LED fixtures shall be thermally protected. They must be passively cooled through conduction unless otherwise noted
- F. LED fixture housing shall be designed to transfer heat from the LED board to the outside environment.
- G. LED fixture manufacturer must provide fixture wattage information and not LED data.
- H. For wet and damp use, LED-based fixture itself shall be sealed, rated, and tested for appropriate environmental conditions, not accomplished by using an additional housing or enclosure.
- I. LED fixture shall be UL listed or UL classified, CE certified. And PSA marked. LED fixture and systems shall meet RoHS (Removal of Hazardous Substances) directives. Manufacturer shall be able to provide supporting documentation of the product meeting third party regulatory compliance as well as environmental testing results.
- J. Manufacturer shall provide optical performance, polar diagrams, and relevant luminance and illuminance photometric data based on test results from an independent testing lab
- K. Rated Life: LED Fixtures shall be rated for 59,000 hour minimum performance on all LED diode components.
- L. Warranty: LED Manufacturers shall provide a minimum 5 year warranty on LED components. Along with it, manufacturer shall provide warranty and comply with the criteria for: color shifting, lumen and color maintenance described below on bullet points 1 and 2.
- M. If extreme color shift or extreme color inconsistency develops within the warranty period, it will be considered a failure and the Manufacturer shall be responsible for replacing all affected fixtures free of charge.

1. Color Shifting: Color must maintained within (+/- 150 Kelvin) and +/- .003 Duv in accordance with LM-80 Test Procedure and color maintenance data to be provided with submittal in a graphical format to show exact spatial movement of each test sample.
2. Lumen and Color Maintenance Criteria of white LEDs
  - a. Lumen Maintenance: The luminous flux of the Source shall not depreciate more than 20% after 50,000 hours of use as extrapolated from LM-80 test data using the TM-21 calculation.
  - b. Reliability Data Submission for color and lumen maintenance: TM-21 extrapolation curve must be provided prior to fixture submission.
- N. ANSI Standards: LED fixtures shall meet ANSI Standards C78.377-2008, Specifications for the Chromaticity of Solid State Lighting Products, and C82.37-2011, Harmonic Emission Limits – Related Power Quality Requirements for Lighting.
- O. IES LM-79 and LM-80: LED Fixtures shall be LM-79-08, Electrical and Photometric Testing of Solid-State Lighting Devices, and LM-80-08, Measuring Lumen Depreciation of LED Light Sources, tested and approved.
- P. NEMA: LED Diodes and Electronic Drivers shall comply with NEMA guideline SSL-3-2010, High-Power White LED Binning for General Illumination, and SSL-1-2010, Electronic Drivers for LED Devices, Arrays, or Systems.

## 2.5 LED DRIVERS: GENERAL REQUIREMENTS

- A. Hardwired connections to LED fixtures shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- B. Driver shall operate at 120 volts and 277 volts with +/- 10% variation tolerance.
- C. LED Driver shall operate LED Line modules.
- D. LED Drivers should have Class 2 output.
- E. LED Driver shall have wide operating window to accommodate variation in Led count and forward voltage variation over life and operating conditions.
- F. LED Driver shall have adjustable output current to optimize lumens and efficacy of luminaires.
- G. When using PMS - Pulse with Modulated Signal (applied to the CTRL pin than can change the LED current) to adjust the brightness of white LED, fixture sample shall be tested at the site prior submission of the PO in order to be tested for electromagnetic and radio interference.
- H. LED Driver should have functionality to protect LED module by monitoring module temperature.
- I. LED Driver shall have connectors suitable for field wiring.
- J. LED Driver shall have maximum case temperature of 75C°.
- K. The enclosure case of the driver must be connected to earth ground when installed in the end-use application.



- L. All LED fixtures and power/data supplies shall be provided by a single manufacturer to ensure compatibility. Manufacturer shall have at least eight years of experience designing, selling and supporting intelligent LED systems.
- M. Total Harmonic distortion (THD): Less than 20% at maximum load under all input voltage.
- N. Power Factor shall be greater than 0.9.
- O. Driver shall tolerate sustained open circuit and short circuit output conditions without damage.
- P. Drivers shall meet all the Regulatory requirements:
  - 1. Driver shall not contain any Polychlorinated Biphenyl (PCB).
  - 2. Driver shall be Underwriters Laboratories (UL) recognized for Dry and Damp location and Canadian Standards Association (CSA) certified where applicable.
  - 3. Driver shall be compliant to UL 1310, First Edition, revised dated November 1, 2011.
  - 4. Driver shall comply with ANSI C62.41 Category A for Transient protection.
  - 5. Driver shall comply with ANSI C82.11 where applicable.
  - 6. Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, part 15 (Radio Frequency Devices) and 18 9dor industrial, scientific and medical equipment)
  - 7. Driver shall comply with NEMA 410 for in-rush current limits.
  - 8. Driver shall meet the RoHS Directive 2002/95EC on the restriction of hazardous substances such as lead, cadmium, mercury, hexavalent chromium, PBBs and PBDEs
  - 9. Driver shall be manufactured in a factory certified to ISO 9001 Quality System Standards.
- Q. Driver replacement parts must be approved by the lighting fixture manufacturer prior installation.

## 2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel 12 gage
- E. Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
  - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- D. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
  - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
  - 5. Continuous Rows longer than 60", where fixture is one piece or an assembly of multiple sections to complete row lengths as defined in specifications:
    - a. Fixtures should be hung straight and true with no waivers or sag initially or over time.
    - b. All suspension points for that fixture shall be perfectly aligned to avoid visible bending and misalignment along the continuous row.
    - c. Provide alignment splines at housing joints to assure tight hairline joints and perfect alignments between housings
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Occupancy Adjustments: When requested within 3 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
  - 1. All adjustable lighting units shall be aimed, focused, locked, etc., by the Subcontractor under the supervision of the Lighting Consultant. The Lighting Consultant shall indicate the number of crews (foreman and apprentice) required. All aiming and adjusting shall be carried out after the entire installation is complete. All ladders, scaffolds, etc. required shall be furnished by the Contractor at the direction of the Lighting Consultant. As aiming and adjusting is completed, locking set-screws and bolts and nuts shall be tightened securely.

2. Adjust aimable luminaires in the presence of Architect or and/or end user shall provide written instruction for aiming intent for all the adjustable fixture

G. Connect wiring according to Division 26.

### 3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency generator and retransfer to normal.
- B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### 3.3 APPENDIX "A"

- A. Lighting Fixture Cuts

END OF SECTION 265100

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\265100\_100CD\_INTERIOR LIGHTING.DOC

## SECTION 283105 - FIRE ALARM CABLES AND PATHWAYS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire alarm cables.
  - 2. Fire-resistive fire alarm cables.
  - 3. Fiber optic cables for fire alarm.
  - 4. Fire alarm terminal cabinets.
  - 5. Fire alarm raceway and boxes.

#### 1.3 DEFINITIONS

- A. Dedicated Continuous Metal Raceway: Enclosed metal pathway dedicated to power-limited fire alarm cable; comprised of and limited to: EMT, IMC, RGS, FMC, and / or LFMC as specified.

#### 1.4 SUBMITTALS

- A. Comply with Division for "Pre-installation Submittals".
- B. Product Data: For each fire alarm cable application, including cable type, wire size, shielding, circuit integrity and electrical characteristics.
  - 1. Include statement from manufacturer's authorized representative that the electrical characteristics of the submitted fire alarm cables are within all operating parameters of the fire alarm system as designed and represented by the detailed fire alarm system shop drawings.
- C. Product Data: For fire alarm terminal cabinets, including furnished options and accessories.
- D. Record of Inspection and Testing: For field wiring inspection and testing; for each circuit indicate measured values and corresponding acceptance criteria for circuit continuity, resistance, stray voltage, ground-faults, short-circuit-faults, and any other manufacturer recommended conductor field testing parameters.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## PART 2 - PRODUCTS

### 2.1 FIRE ALARM CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Belden Inc.
  - 2. Southwire Co.
  - 3. West Penn Wire.
  - 4. Or equivalent.
- B. Multi-conductor Cable: UL 1424, Type FPL, FPLR and FPLP, power-limited fire alarm cable; jacketed, twisted-pair solid copper conductors; unshielded and shielded.
- C. Multi-conductor Metal-clad Cable: UL 1424, Type MC-FPLP, power-limited fire alarm cable; jacketed, twisted-pair solid copper conductors with aluminum interlocking outer armor jacket; unshielded and shielded.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Red Alert MC-FPLP cable, manufactured by Southwire Co.

### 2.2 FIRE-RESISTIVE FIRE ALARM CABLES

- A. Multi-conductor Fire-resistive Cable: UL 2196 fire resistive, Type FPL, power-limited fire alarm cable; ceramifiable silicon insulation; jacketed, solid copper conductors; unshielded and shielded.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Duralife FPL fire resistive alarm cable, manufactured by Radix Wire Co.

### 2.3 FIRE ALARM TERMINAL CABINETS

- A. Enclosure: 16 gauge steel; factory applied red enamel finish; removable hinged door with keyed locking latch; with embedded 1/2 inch, 3/4 inch, 1 inch, 1-1/2 inch and 2 inch knockout clusters.
- B. Terminals: Each terminal pole with quick-connect wire termination points and integral test port; sized to accept 20 - 12 AWG and rated for 20 amp at 250V (Class B/UL) 300V (CSA).
- C. Identification: Marked "FIRE ALARM TERMINAL CABINET" in 2 inch white factory applied indelible screened lettering; field identification labels on the inside cover corresponding to the terminal strip's labeling inside the back box.

- D. Basis-of-Design Product: Subject to compliance with requirements, provide IF-Series fire alarm terminal cabinets, manufactured by Space Age Electronics Inc.

## 2.4 FIRE ALARM RACEWAY AND BOXES

- A. Comply with Division 26.
  - 1. Finish: Factory applied red finish for cover plates and connectors.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with NFPA 70 and NFPA 72.
- B. Unless more restrictive requirements are noted in Division 28, comply with applicable Division 26 sections for the installation of low voltage electrical systems.
- C. Comply with Division for NFPA 72 pathway Class and Survivability Level requirements.

### 3.2 FIRE ALARM PATHWAY INSTALLATION

- A. Pathways for Fire Alarm: The pathway system for fire alarm shall be dedicated continuous metal raceway throughout.
  - 1. Comply with Division 26 for application and installation of EMT, IMC, RGS, FMC, and LFMC with respect to environmental conditions and resistance to physical damage.
  - 2. MC fire alarm cable shall be permitted in place of Continuous Metal Raceway for the following applications:
    - a. Above finished ceilings.
- B. Pathways beneath Slab, Within Slab, and Buried: Comply with Division 26 for applicable RNC installation requirements.
- C. Class A and X Pathways: Unless greater distances are indicated on the Drawings or Specifications, install Class A and X pathways in compliance with NFPA 72 recommendations for minimum horizontal and vertical separation between supply and return pathways.

### 3.3 FIRE RESISTIVE PATHWAY INSTALLATION

- A. Where NFPA 72 Survivability Level 2 or 3 pathways (2-hr fire resistance rated) are indicated or required, provide one of the following:
  - 1. UL 2196 fire resistive fire alarm cable (Category FHJR) installed within metal raceway in accordance with the corresponding UL "Circuit Integrity System" (Category FHIT).

2. UL 1424 fire alarm cable installed within metal raceway protected by an endothermic wrap assembly installed in accordance with the corresponding UL "Circuit Integrity System" (Category FHIT).
  - a. Basis-of-Design Product: Interam Endothermic Mat, manufactured by 3M.

### 3.4 FIRE ALARM CABLE INSTALLATION

- A. Fire Alarm Cable Applications: For each fire alarm circuit application, comply with Drawings for cable type, minimum wire size, shielding, and color coding.
- B. Install fire alarm cables within raceway. Wiring shall be continuous between equipment, device, and appliance terminals without splices.
- C. T-tapping: Not permitted for any fire alarm circuit.
- D. Do not install fire alarm system wiring within conduits, junction boxes, or outlet boxes containing conductors of lighting or power systems.
- E. Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess.
- F. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams.
- G. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal.

### 3.5 GROUNDING

- A. Comply with Division 26.

### 3.6 FIELD QUALITY CONTROL

- A. Field inspections and testing shall be performed by fire alarm system manufacturer's factory-authorized service technicians.
- B. End-to-end cabling shall be considered defective if it does not pass tests and inspections.
- C. Perform visual wiring inspections in accordance with fire alarm system manufacturer recommendations. Correct deficiencies.
- D. Test wiring in accordance with fire alarm system manufacturer requirements and NFPA 72 for Initial Acceptance Testing of conductors. Correct deficiencies.
- E. Document inspections and tests via formal inspection test and report(s).

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\283105\_FIRE ALARM CABLES AND PATHWAYS.DOC



## SECTION 283111 - DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Power supplies.
  - 2. Manual fire alarm boxes.
  - 3. System detectors.
  - 4. Notification appliances.
  - 5. Addressable interface modules.
  - 6. Fault isolation modules.
  - 7. Magnetic door holders.
  - 8. Surge protection devices.
  - 9. Maintenance bypass switches.

#### 1.3 DEFINITIONS

- A. ADS: Acoustically Distinguishable Space.
- B. AHJ. Authority Having Jurisdiction.
- C. BMS: Building Management System.
- D. EVACS: Emergency Voice Alarm Communication System.
- E. FACU: Fire Alarm Control Unit.
- F. FATC: Fire Alarm Terminal Cabinet.
- G. IDC: Initiating Device Circuit.

- H. NAC: Notification Appliance Circuit.
- I. NICET: National Institute for Certification in Engineering Technologies.
- J. PSTN: Publically Switched Telephone Network.
- K. SLC: Signaling Line Circuit.

#### 1.4 SUBMITTALS

- A. Comply with Division 20 for common mechanical/electrical requirements.
- B. Comply with Division 28 specifications and drawings; state/local regulations; and NFPA 72 - Chapter "Documentation". For purposes of applying NFPA 72, all identified documentation requirements are a mandatory part of the Work, including those that "apply only where required by other governing laws, codes, or standards, by other parts of the Code; or by project specifications or drawings".
- C. Submit "Pre-installation Submittals" prior to applying for authority having jurisdiction installation permits (where required) and system installation.
- D. Submit "Approval Testing Submittals" after successful initial system testing and prior to scheduling authority having jurisdiction final approval demonstration testing.
- E. Submit "Closeout Submittals" as part of project closeout procedure.

#### 1.5 PRE-INSTALLATION SUBMITTALS

- A. Qualification Data: For Designers and Field Technicians.
  - 1. Include NICET certifications and fire alarm system manufacturer training certifications.
- B. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include approvals and listings, construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
  - 3. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements of this Specification and of NFPA 72.
- C. Seismic Qualification Certificates: For fire alarm control unit, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- D. Sample Warranty: For special warranty.
- E. Shop Drawings: For fire alarm system and fire safety control interfaces.
  - 1. Floor Plans. Include floor plans to indicate final equipment, cabinet, device and appliance locations. Indicate address of each addressable device. Show all interface modules. Show candela setting for each strobe appliance. Show complete point-to-point routing of all circuits and pathways; indicate Class and Survivability Level. Show size and type of all conduits, cable, wire, and conductors. Indicate panel circuit designation for each normal power supply branch circuit.
  - 2. Riser Diagram. Include complete device/appliance accurate riser diagram. Indicate address of each addressable device. Show all interface modules. Show candela setting of each strobe appliance. Show each circuit and pathway; indicate Class and Survivability Level. Show size and type of all conduits, cable, wire, and conductors. Indicate panel circuit designation for each normal power supply branch circuit.
  - 3. Equipment Wiring Diagrams. Include wiring diagrams for each system component/node including control unit cabinets, remote power supply cabinets, terminal cabinets, remote annunciators, supervising station transmitters, and PC workstations.
  - 4. Component Wiring Diagrams. Include typical wiring diagrams for fire detector bases, pull stations, conventional devices, interface modules including wiring connections to supervised/controlled equipment, notification appliances, and component modules and cards.
  - 5. Ductwork Smoke Detector Plans. Include installation details for each ductwork detector condition. Show plan and section view for each condition. Show requirements for ductwork attachments, penetrations, and access panels.
  - 6. Calculations - Voltage Drop. Include voltage drop calculations inclusive of safety/spare capacity factor(s) for notification-appliance circuits. Calculations shall assume alarm operation using the minimum standby power available at the conclusion of quiescent and alarm phases of operation.
  - 7. Calculations - Power Supply and Battery Capacity. Include power capacity calculations inclusive of safety/spare capacity factor(s) for each system power supply and connected battery set.
  - 8. Calculations - Conduit Fill. Include conduit fill calculations prepared in accordance with the National Electric Code.
  - 9. Sequence of Operation. Include complete and detailed input/output sequence of operation matrix. Supplement matrix with narrative descriptions for complex specialty sequences.
  - 10. Emergency Voice/Alarm Communication Systems; additionally:
    - a. Floor Plans. Indicate amplifier equipment cabinets, primary and remote paging locations, and associated circuits and pathways. Show wattage tap and corresponding ADS for each speaker. Indicate circuit pathway Class and Survivability Level.
    - b. Equipment Wiring Diagrams and Component Wiring Diagrams. For amplifier racks, remote microphone stations, and speaker appliances.
    - c. Amplifier Loading. For each speaker circuit, identify quantity of speakers at each wattage tap setting and total connected wattage per circuit and per amplifier. Demonstrate calculated loading inclusive of safety/spare capacity factor(s) is accommodated by amplifier nominal power (watts) capacity.
    - d. Audio dB Loss Calculations. For each speaker circuit.
    - e. Power Supply Battery Capacity Calculations. For each amplifier array power supply and connected battery set, inclusive of safety/spare capacity factor(s).

- F. Delegated-Design Submittals – For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.6 APPROVAL TESTING SUBMITTALS

- A. Statement of Completion: Written statement that system has been installed in accordance with approved plans and tested in accordance with the manufacturer’s published instructions and appropriate NFPA 72 requirements.
- B. Record of Inspection and Testing. Detailed documentation of completed 100 percent fire alarm and signaling system initial acceptance testing. Use NFPA 72 “System Record of Inspection and Testing” forms.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Record of Completion. Provide detailed description of installed, tested, and approved fire alarm and signaling system; including description of protected premises, fire alarm system and component sub-systems, fire safety function interfaces, monitoring service, and all other information required by NFPA 72. Use NFPA 72 “System Record of Completion” forms.
- B. Record Drawings. Provide complete Shop Drawing re-submittal updated to reflect actual final system installation and sequence of operation of all components.
- C. Device address list. Provide complete device address list organized by SLC loop and system node.
- D. Operation and Maintenance Data: For fire alarm systems and components to include in emergency, operation, and maintenance manuals.
  - 1. Provide manufacturer's Owner’s Operation and Maintenance Manuals with required related system warranty requirements.
  - 2. Provide NFPA 72 “Inspection, Testing, and Maintenance” tables indicating required component inspection and testing activities and frequencies.
  - 3. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
- E. Software and Firmware Operational Documentation:
  - 1. Provide software operating and upgrade manuals.
  - 2. Site-specific Software Backup: Provide on compact solid state USB storage device or compact disk; complete with data files.

#### 1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Smoke Detectors and Heat Detectors: Five (5) of each type installed.
2. Detector Bases: Five (5) of each type installed.
3. Audible and Visual Notification Appliances: Five (5) of each type installed.
4. Keys and Tools: One extra set for access to locked or tamper-proof components.
5. Fuses: Two (2) of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

#### 1.9 QUALITY ASSURANCE

- A. Field Technician Qualifications: Personnel trained and certified by the fire alarm system manufacturer as an approved technician.
- B. Designer Qualifications: Shop Drawings and Calculations prepared by personnel certified by NICET as fire alarm Level III or IV technician.
- C. Source Limitations for Fire alarm System and Components: Single vendor source to provide fire alarm system components and connected non-system components as a single listed addressable fire alarm and signaling system.
  1. Modifications to Existing Systems: Components compatible with, and operate as an extension of, existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  1. Specific Agency Requirements for All Products: Underwriters Laboratories (UL) listed and Factory Mutual (FM) Approved.
- E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

#### 1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  2. Warranty Period: Five (5) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products listed as a component of a single addressable fire alarm and signaling system technology platform by one of the following:
  - 1. SimplexGrinnell LP; a Tyco International company.
- B. Where additional manufacturer listings or basis of design products are indicated, provide products listed and duty-rated as compatible with the selected fire alarm and signaling technology platform.

### 2.2 SYSTEM DESCRIPTION

- A. UL 864; non-coded, microprocessor-based addressable protected premises fire alarm and signaling system, with multiplexed signal transmission and audible/visual evacuation signaling. All components provided listed for use and compatible with fire alarm system head-end FACU.
- B. Protected premises backbone architecture comprised of multiple fire alarm control units and system components networked via peer-to-peer communications node network.
- C. Control units, system components, and power supplies inclusive of boards, drivers, and expansion modules necessary to support the specified system performance criteria, minimum quantity of circuits, and NFPA 72 circuit pathway class designations.
- D. System circuiting and component power loading to provide minimum specified spare capacities, safety factors, and redundancies.
- E. NFPA 72 Pathway Class (Performance During Fault) and Survivability Level (Fire Resistance):
  - 1. Addressable signaling loops.
    - a. Circuit Type: SLC.
    - b. Pathway Class: A.
    - c. Class A Short-circuit Fault Isolation Modules or Bases Located as Follows:
      - 1) At each SLC exit/entry point of from/to a control unit or terminal cabinet.
      - 2) No more than twenty (20) addressable devices between isolation modules at any point on SLC.
    - d. Pathway Survivability Level: 1.
  - 2. Audible and intelligible public mode signaling (occupant evacuation).
    - a. Circuit Type: NAC.
    - b. Pathway Class: A.
    - c. Pathway Survivability Level: 1.
  - 3. Visible public mode signaling (occupant evacuation).
    - a. Circuit Type: NAC.

- b. Pathway Class: A.
  - c. Pathway Survivability Level: 1.
- 4. Audible and visible private mode signaling.
  - a. Circuit Type: NAC.
  - b. Pathway Class: A.
  - c. Pathway Survivability Level: 1.
- 5. Supervision of conventional devices.
  - a. Circuit Type: IDC.
  - b. Pathway Class: A.
  - c. Pathway Survivability Level: 1.
- 6. Fail-safe operation, magnetic door holders and similar.
  - a. Circuit Type: Fail safe.
  - b. Pathway Class: D.
  - c. Pathway Survivability Level: 1.
- 7. Communication between fire alarm network nodes and digital audio risers.
  - a. Circuit Type: Comm and DVC.
  - b. Pathway Class: X.
  - c. Pathway Survivability Level: 3.
- 8. Partial evacuation or relocation EVACS; critical circuits that effect the operation of more than one (1) evacuation zone, and circuits located outside of the evacuation zone they serve.
  - a. Circuit Type: NAC, and SLC.
  - b. Pathway Class: A.
  - c. Pathway Survivability Level: 3.
- 9. Stairwell pressurization initiation, control, and supervision.
  - a. Circuit Type: SLC.
  - b. Pathway Class: A.
  - c. Pathway Survivability Level: 3.
- F. All addressable circuits designed and installed without T-taps.
- G. Maximum 100 addressable alarm-initiating devices on each SLC.
- H. No fewer than two (2) visible and two (2) audible NAC's serving each protected premises fire area or evacuation zone. Unless noted otherwise, notification appliances circuited such that no two adjacent appliances are connected to the same NAC.
- I. Component Primary Power: 24-V dc obtained from premises AC power supply.
  - 1. Capacity: Alarm current draw of components connected to each power-supply module no greater than 80 percent of the power-supply module rating.

- J. Component Standby Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  - 1. Base Capacity: System operation for twenty-four (24) hours under quiescent load plus five (5) minutes operating all alarm notification appliances.
  - 2. Spare Capacity: 20 percent.
- K. Remote power supplies used as distributed power sources only and not as in-line circuit power “boosters”.
- L. Fire alarm system listed for protected premises in-building Emergency Voice Alarm Communications System (EVACS) service utilizing digital multi-channel technology:
  - 1. Fire Emergency Voice Alarm Communications Systems (EVACS); comply with UL 864, 1480, and 1711.
  - 2. Mass Notification System (MNS); comply with UL 2572.
  - 3. Amplifier loading no greater than 80 percent of rated power capacity (Watts).
  - 4. Complete functional integration (common audio circuits and speakers) of protected premises fire alarm in-building EVACS and premises Public Address System (PAS).
- M. Complete end-to-end fire alarm system interfaces with other premises building systems including Fire Suppression, HVAC, Vertical Transportation, Audio/Visual, Public Address, Access Control, Fire Protection Opening Protectives, Emergency Power, and similar for all code-required and project-specified fire safety supervision and functional control.
- N. Complete fire alarm system end-to-end control and supervision of building smoke control system(s) including automatic operation, manual operation, and indication of smoke control system component status. Comply with UL 864 UUKL.
- O. Retransmission of protected premises alarm, supervisory, and trouble status signals (Contact ID format) to an AHJ approved alarm supervising station.
- P. Wide-area Campus/Site Integration.
  - 1. Complete functional integration of protected premises in-building fire alarm network nodes with wide-area campus/site fire alarm node network to form a global peer-to-peer fire alarm network.
  - 2. Complete functional integration of protected premises in-building fire alarm network nodes with wide-area campus/site fire alarm node network via contact-id signal transmission to proprietary supervising station alarm receiver.
  - 3. Complete functional integration of protected premises in-building EVACS and campus/site Wide Area Mass Notification System (WAMNS).

## 2.3 PERFORMANCE REQUIREMENTS

- A. Operational Performance: Fire alarm system shall process alarm, supervisory, and trouble status signals and perform associated output functions in compliance with NFPA 72, Division 28 and Drawings “Input/Output Matrix”.



- B. Circuit Integrity and Fault Performance: Fire alarm system circuit integrity and functional performance capability under fault conditions shall comply with the NFPA 72 circuit Class designations as indicated within the "System Description" Article and as indicated on the Drawings.
- C. Survivability Performance: Fire alarm system fire resistive performance capability shall comply with the NFPA 72 circuit Level designations as indicated within the "System Description" Article and as indicated on the Drawings.
- D. Seismic Performance: Fire alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

## 2.4 POWER SUPPLIES

- A. General: Switched-mode supervised power supply base and expansion modules supplying regulated and filtered 24-V dc power to system components, notification appliances, and auxiliary power loads.
- B. FACU Applications: Power supply modules and batteries mounted within Fire Alarm Control Unit (FACU) equipment cabinets to provide integral system power to chassis-mounted components, connected notification appliance circuits, and connected auxiliary power circuits; batteries located within stand-alone battery cabinet for high-capacity applications.
- C. RPS Applications: Power supply modules and batteries mounted within distributed Remote Power Supply (RPS) equipment cabinets to provide supplemental power to connected notification appliance circuits and connected auxiliary power circuits.
- D. Primary Power Supply: 120-V ac.
- E. Secondary Power Supply: 24-V dc supply system including sealed lead acid batteries, automatic float-charge battery charger, and automatic transfer switch.
- F. Outputs: Programmable for operation as Notification Appliance or Auxiliary Power circuits; NAC outputs capable of operation as sync-generator or sync-follower; capable of supporting Class A or Class B circuit configuration.
- G. Supervision: Loss of primary power, low battery power, battery charger failure, and output circuit faults conditions supervised by fire alarm system via serial communication or system SLC supervision of trouble contacts.
- H. Cabinet Enclosures: Comply with Article "Fire Alarm Control Units" for cabinet enclosures.

## 2.5 MANUAL FIRE ALARM BOXES

- A. General: UL 38; red finish, with molded, raised-letter operating instructions and "FIRE" identification in contrasting color; shall show visible indication of operation.
- B. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral or attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire alarm control unit.

- C. Station Reset: Key- or wrench-operated switch.
- D. Weatherproof Protective Cover: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

## 2.6 SYSTEM FIRE DETECTORS

- A. General: Analog addressable system smoke, system heat, or other system detectors for sensing products of combustion; listed as compatible with fire alarm system control unit and with integral addressable module capable of two-way analog communication with fire alarm control unit permitting remote sensitivity control, identification of device address, alarm status, trouble status, and trending of maintenance data.
- B. Detector Housing: Low profile, white-polycarbonate thermoplastic, impact resistant, and flame retardant detector housing for mounting into twist-lock base; with LED indicator for indication of detector status-poling (flashing) or in operation (constant).
- C. Detector Bases: Ceiling- and wall-mount, low profile, white-polycarbonate thermoplastic, impact resistant, and flame retardant plastic twist-lock fixed base; with terminals for SLC conductor terminations.
  - 1. Auxiliary Detector Bases: Optional bases furnished to perform supplemental detector-local functions.
    - a. Sounder bases to provide local audible alarm at detector; 24-V dc.
    - b. Relay bases for output control of associated equipment.
    - c. Isolation bases to isolate short circuit faults on SLC.
    - d. UL 2075 carbon monoxide sensor and associated distinct audible alarm and visual indicator.
- D. Remote Alarm Indicators (RAI): LED visual indicator in flush-mount plate, connected to corresponding detector base terminals for remote indication of detector alarm.
- E. Remote Test Station (RTS): RAI with key operated test switch for remote detector testing.
- F. Operating Voltage: 24-V dc nominal for detectors and auxiliary bases; 120-V ac rated contacts for relay bases as per application.
- G. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

## 2.7 SYSTEM SMOKE DETECTORS

- A. Comply with "System Fire Detectors" Article.
- B. UL 268, photoelectric spot-type with insect-screen protected sensing chamber; for installation in twist-lock system bases.
- C. Operating Temperature Range: 32 – 100 deg F (0 – 38deg C).
- D. Operating Humidity Range: 10 - 95 percent RH.

- E. Sensitivity Range: 0.2 - 3.7 percent obs/ft.
- F. Air Velocity Rating: 0 - 4,000 fpm (0 - 1220 mpm).

## 2.8 SYSTEM IN-DUCT SMOKE DETECTORS

- A. UL 268A, photoelectric spot-type system smoke detector listed for installation directly within air distribution ductwork; with and without integral output relays.
- B. Mounting: For square and round ducts via factory furnished mounting kit or standard electrical raceway and boxes as per detector manufacturer requirements.
- C. Air Velocity Range: 0 - 4,000 fpm (0 - 1,220 mpm).

## 2.9 SYSTEM SAMPLING TUBE DUCT SMOKE DETECTORS

- A. Comply with "System Fire Detectors" Article.
- B. UL 268A, photoelectric spot-type system smoke detector listed for installation within detector housing mounted to exterior surface of air distribution ductwork, with connected sampling tubes transporting ductwork air to the external detector sensing chamber; with and without integral output relays.
- C. Mounting: For square and round ducts via factory furnished mounting kit.
- D. Air Velocity Range: 300 - 4,000 fpm (91 - 1,220 mpm).

## 2.10 SYSTEM HEAT DETECTORS

- A. Comply with "System Fire Detectors" Article.
- B. UL 521, sport type heat detector actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless other temperature rating(s) are indicated on Drawings.

## 2.11 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Same manufacturer as the selected manufacturer of the fire alarm and signaling system technology platform.
  - 2. Edwards Signaling.
  - 3. System Sensor.
  - 4. Wheelock, Cooper Industries.
  - 5. Or equivalent.

- B. General Performance Requirements for Notification Appliances: Signaling appliances connected to notification appliance circuits for NFPA 72 public operating mode signaling to building occupants protected by the fire alarm system; and private operating signaling to those persons directly concerned with implementation and direction of emergency action and procedures. Appliance assemblies include audible, audible/intelligible, visible, and combination type as indicated on Drawings.
- C. Mounting: Wall or ceiling mount as indicated on Drawings.
- D. Housing: Thermoplastic, impact resistant, and flame retardant.
- E. Finish: White housing with Red contrasting engraved lettering.
- F. Identification: Engraved lettering on housing indicating "FIRE".
- G. Weather proof applications: Listed for indoor and outdoor installation.

#### 2.12 AUDIBLE NOTIFICATION APPLIANCES

- A. Comply with "Notification Appliances" Article.
- B. Horns: UL 464, electric-vibrating-polarized type horn within dedicated housing, 24-V dc; listed sound-pressure level of 90 dBA measured 10 feet.
- C. Bells: UL 464; 6 inch diameter, vibrating motor type bell, 24-V dc; red finish, listed for indoor and outdoor applications.

#### 2.13 VISIBLE NOTIFICATION APPLIANCES

- A. Comply with "Notification Appliances" Article.
- B. Strobes: UL 1971, xenon strobe with clear polycarbonate lens mounted on an aluminum faceplate and field selectable candela output setting within dedicated housing, 24-V dc; with candela setting indicator visible through viewing window.
  - 1. Strobe flashing in temporal pattern, synchronized throughout each evacuation zone and synchronized between evacuation zones where strobes from multiple evacuation zones can be observed by a single viewer.
  - 2. Comply with Drawings for appliance candela output.
- C. Flashing Beacons: UL 1638; 6 inch diameter, red lens beacon, 24-V dc; listed for indoor and outdoor applications.

#### 2.14 COMBINATION AUDIBLE AND VISIBLE NOTIFICATION APPLIANCES

- A. Combination audible and visible notification appliance with audible and visible signaling elements assembled within a common housing.
  - 1. Audible horn - comply with "Audible Notification Appliances" Article.

2. Visible strobe - comply with "Visible Notification Appliances" Article.

#### 2.15 ADDRESSABLE INTERFACE MODULES

- A. General: Microelectronic interface module for supervision and control of premises fire safety functions with integral address-setting means, internal code for FACU identification by module type, and output contact ratings to match controlled/supervised equipment.
- B. Monitor Module: Provides a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Relay Module: Capable of providing a direct output signal to controlled equipment or device.
  1. Allows the FACU to switch the relay contacts on command.
  2. Minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module: Capable of providing a supervised direct output signal to controlled notification appliance, equipment or device.
  1. Allows the FACU to switch the relay contacts on command.
  2. Minimum of two normally open and two normally closed contacts available for field wiring.

#### 2.16 FAULT ISOLATION MODULES

- A. Module capable of sensing and automatically isolating SLC short circuit fault.

#### 2.17 MAGNETIC DOOR HOLDERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Bosch Security Systems Inc.
  2. Rixson, Yale Security Inc.
  3. RSG Inc.
  4. Or equivalent.
- B. Description: Normally powered hold opens, fail-closed; equipped for wall or floor mounting and complete with matching doorplate.
  1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
  2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
  3. Operating Voltage: 120-V ac.
- C. Material and Finish: Match door hardware.

2.18 SURGE PROTECTIVE DEVICES

- A. General: UL 497B, hybrid gas discharge tube/diode technology surge protective devices; listed for power-limited fire alarm circuit applications intended to prevent component damage or nuisance alarms induced by lightning strikes, stray currents, or voltage transients.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Citel America Inc.
  - 2. Ditek Corp.
  - 3. Space Age Electronics, Inc.
  - 4. Transtector Systems, Inc.
  - 5. Or equivalent.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare and submit "Pre-Installation Submittals" prior to equipment procurement.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Confirm fire resistance rating of building construction required to perform as fire alarm system Survivability protection before installation.
- C. Examine depth of stud walls to verify clearance for flush-mount equipment before installation.
- D. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- E. Examine proposed mounting locations of equipment cabinets with user displays and/or controls with the local fire official to verify satisfactory access and ease of identification before installation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 EQUIPMENT INSTALLATION

- A. Comply with the most restrictive requirements of this Section and applicable Division 26 sections for the installation of low voltage electrical systems.
- B. Comply with NFPA 72, and requirements of authorities having jurisdiction for installation and testing of fire alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- C. Arrange equipment cabinets, wire-ways, and conduits with adequate clearances to facilitate access for inspection, maintenance, and component replacement.
- D. Install equipment cabinets with top and bottom of cabinets not more than 72 inches above finished floor and not less than 12 inches above finished floor, respectively.
- E. Install battery cabinets with top and bottom of cabinets not more than 48 inches above finished floor and not less than 12 inches above finished floor, respectively.
- F. Install fire alarm system modules and auxiliary components in accessible locations with bottom of modules and components not less than 12 inches
- G. Install equipment cabinets with user displays and/or controls including fire alarm control unit nodes and remote annunciators with displays and/or controls at natural user height.
- H. Flush-mount equipment cabinets/back-boxes not located in designated equipment rooms.
- I. Flush-mount wall- and ceiling-mounted initiating devices, modules, indicators, and notification appliances unless otherwise indicated.
- J. Surface-mount equipment cabinets/back-boxes located in designated equipment rooms.
- K. Surface-mount initiating devices, modules, indicators, and notification appliances installed on concrete or masonry unit walls.
- L. Surface-mount initiating devices installed to the underside of building structure.
- M. Surface-mount or pendant-mount notification appliances installed to the underside of structure.
- N. Install ceiling mounted devices, modules, indicators and notification appliances in alignment with adjacent ceiling fixtures and centered within ceiling tiles.
- O. Install wall mounted devices, modules, indicators and notification appliances in alignment with adjacent switches and wall fixtures.
- P. Do not install addressable devices in areas subject to temperature extremes. Use conventional initiating devices supervised by addressable monitor modules remotely located within an adjacent conditioned space.
- Q. Weather-proof – RESERVED.

### 3.4 CABLE AND PATHWAY INSTALLATION

- A. Comply with Division 28.

### 3.5 INSTALLATION FOR SURVIVABILITY

- A. Where NFPA 72 Survivability Level 2 or 3 pathways are indicated or required, install fire alarm system cables and pathways within 2-hr fire resistance rated enclosures or comply with Division 28 for “Fire Resistive Pathway Installation”.
- B. Install control units, amplifiers, power supplies, junction boxes, terminal cabinets, or similar components within dedicated 2-hr fire resistance rated fire alarm system equipment rooms where the components originate or comprise a portion of a NFPA 72 Survivability Level 2 or 3 pathway.

### 3.6 MANUAL FIRE ALARM BOX INSTALLATION

- A. Install manual fire alarm boxes in the normal path of egress within 60 inches of the exit doorway.
- B. Install manual fire alarm boxes with operable handles between 42 inches and 48 inches above finish floor level.
- C. Install all manual fire alarm boxes at a common elevation with respect to finished floor.
- D. Install manual fire alarm boxes on a background of a contrasting color.

### 3.7 SYSTEM SPOT-TYPE FIRE DETECTOR INSTALLATION

- A. Locate spot-type fire detectors in a manner that readily permits access – without the need of a lift - from the floor below for detector inspection, testing, and maintenance.
- B. Install fire detectors only after all dust and debris producing work is completed.
- C. Maintain factory provided detector covers on fire detectors until fire alarm system is approved for closeout and turnover.
- D. Install Remote Alarm Indicators in a visible location for each group of fire detector located within a normally locked room or area.
- E. Spot-type Smoke- and Heat-Detector Locations and Spacing:
  - 1. Comply with Drawings, and;
  - 2. Comply with NFPA 72 "Smoke-Sensing Fire Detectors".
  - 3. Comply with NFPA 72 "Heat-Sensing Fire Detectors".

### 3.8 INSTALLATION OF AIR DISTRIBUTION DUCTWORK DETECTORS

- A. Comply with NFPA 72, International Mechanical Code, and NFPA 90A.
- B. Install duct smoke detectors in accordance with manufacturer’s installation guidelines.
- C. Locate duct detectors in a manner that readily permits access for detector inspection, testing, and maintenance.



- D. Plan and coordinate duct detector locations and mounting requirements with Division 23 prior to ductwork fabrication and installation; show coordinated duct detector layout on Coordination Drawings and Shop Drawings.
- E. Furnish duct detector housings and ductwork attachments for installation under Division 23. Coordinate requirements for ductwork penetrations, attachments, sealant, and access panels with Division 23.
- F. Do not install duct detectors, housings, or sampling tubes in ductwork until all dust and debris producing work is complete and air distribution system cleaning and startup is complete. Duct detector housings may be attached to ductwork and connected to SLC/IDC prior to air distribution system startup provided they are protected from dust and debris using factory covers.
- G. Air Distribution Equipment Shutdown Applications: Use sampling-tube type system duct smoke detectors.
  - 1. Supply Air Systems: Locate duct smoke detectors downstream of fans and filters.
  - 2. Return Air Systems: Locate duct smoke detectors upstream of filters, exhaust air connections, outdoor air connections or decontamination equipment.
- H. Fire/Smoke Damper Control Applications: Where dampers are provided with conventional duct smoke detectors integral to the fire/smoke dampers (Division 23) supervise duct smoke detector alarm and trouble contacts via addressable interface modules.
- I. Fire/Smoke Damper Control Applications: Use sampling-tube type system duct smoke detectors.
  - 1. Locate duct smoke detectors within 5 ft of the associated damper.
  - 2. Locate and support duct smoke detectors in accordance with manufacturer's installation guidelines.
- J. Applications for Detection of Carbon Monoxide within Air Distribution Ductwork: Locate carbon monoxide duct detectors within supply air ductwork served by fuel-fired air distribution equipment in accordance with applicable State or Municipal regulations.
- K. Install remote alarm test stations at each duct detector in readily accessible location that does not interfere with other sections of the Work.

### 3.9 NOTIFICATION APPLIANCE INSTALLATION

- A. Comply with Drawings and NFPA 72 "Notification Appliances".
- B. Wall-mounted Audible Notification Appliances: Install with top of appliance not less than 6 inches below the finished ceiling and not less than 90 inches below the finished floor.
- C. Wall-mounted Visible and -Combination Audible/Visible Notification Appliances: Install with top of appliance not less than 6 inches below the finished ceiling and the entire appliance strobe lens not less than 80 inches and not more than 96 inches above the finished floor.
- D. Install all wall-mounted notification appliances with top of appliance at a common elevation with respect to finished floor.

- E. Install exterior flashing beacons such that they are clearly visible from the primary fire department vehicle access route; and as indicated on Drawings. Use a dedicated NAC for each beacon.
- F. Install exterior alarm bells adjacent to each sprinkler fire department inlet connection; and as indicated on Drawings. Use a dedicated NAC for each bell.

### 3.10 CONNECTIONS AND INTERFACES

- A. Make connections to premises building systems and components via addressable interface modules. Include necessary interface modules, relays, wiring, resistors, and components as required to achieve the input/output sequence of operations performance criteria indicated by the Drawings.
- B. Coordinate voltage and current ratings of connected components such that connections and interfaces operate within listed limitations. Use interposing relays where connected loads exceed rating of addressable interface modules.
- C. Arrange connections and interfaces such that circuits are monitored for integrity as required by NFPA 72.
- D. Interface to premises systems and components requiring fire alarm supervision of status with addressable interface monitor modules.
- E. Interface to premises Preaction Sprinkler solenoids and/or Fire Extinguishing System actuators with addressable interface control modules listed for releasing service. Install a key operated maintenance disconnect switch in the releasing circuit to permit fire alarm system component testing without solenoid/actuator release. Operation of the maintenance disconnect switch be monitored by the fire alarm system as a supervisory condition.
- F. Interface to premises systems and components requiring Emergency Control Function Interface with addressable interface relay modules installed within 36 inches of the interface wiring termination point.
- G. Each addressable interface relay module used for Emergency Control Function Interface shall include one (1) set of spare contacts for monitoring connection to the premises Building Management System, Security System, or similar secondary premises system.
- H. For each HVAC air distribution unit, coordinate with Division 23 for exact interface requirements, quantity of fan drives, and detailed sequencing for proper shutdown of the associated air distribution equipment.

### 3.11 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with Division 26.
- B. Label addressable initiating devices and bases and notification appliances. Comply with Drawings.
- C. Install framed instructions adjacent to the fire alarm control unit. Installed instructions shall be typewritten computer printout instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

3.12 GROUNDING

- A. Comply with Division 26.
- B. Comply with fire alarm system manufacturer installation guidelines for grounding.
- C. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit

3.13 FIELD QUALITY CONTROL

- A. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Devices placed in service before all other trades have completed cleanup shall be replaced.
- C. Field inspections and testing shall be performed by fire alarm system manufacturer's factory-authorized service technicians.
- D. Smoke Control Systems: In addition to Div. 28 fire alarm system inspection and testing requirements, perform additional inspections and integrated functional testing as required to support smoke control system Special Inspections commissioning.
- E. Prepare a typewritten computer-output Test Plan that clearly establishes the scope of fire alarm and signaling system testing. Include at a minimum testing methods, personnel, duration, planned impairments, and required coordination for integrated testing of emergency control function interfaces.
- F. Functional field tests shall be witnessed by the Construction Manager (CM) and their designees; provide notifications a minimum of two (2) weeks in advance.
- G. Acceptance field testing shall be witnessed by the CM, their designees, and authorities having jurisdiction (AHJ); provide notifications a minimum of two (2) weeks in advance.
- H. Perform visual inspections in accordance with fire alarm system manufacturer recommendations and NFPA 72 for Initial Acceptance Inspections. Correct deficiencies.
- I. Document inspections by completing applicable sections of the NFPA 72 "System Record of Inspection and Testing" report.
- J. Provide written notifications for functional field tests; include Test Plan.
- K. Perform functional testing in accordance with fire alarm system manufacturer recommendations and NFPA 72 for "Initial Acceptance Testing". Correct deficiencies. Repeat functional testing including retesting of unaffected components in accordance with NFPA 72 for "Reacceptance Testing".
- L. Document 100 percent satisfactory functional tests by completing remaining sections of the NFPA 72 "System Record of Inspection and Testing" report.
- M. Submit NFPA 72 "Statement of Completion" and completed NFPA 72 "System Record of Inspection and Testing" report.

- N. Provide written notifications for acceptance field tests; include Test Plan, NFPA 72 “Statement of Completion”, NFPA 72 “System Record of Inspection and Testing” report, and NFPA 72 “System Record of Completion”.
- O. Perform acceptance field testing. Demonstrate system operation to the satisfaction of the AHJ. Correct AHJ noted deficiencies. Repeat functional testing including retesting of unaffected components in accordance with NFPA 72 for “Reacceptance Testing”. Amend NFPA 72 “System Record of Inspection and Testing” report, and NFPA 72 “System Record of Completion”.
- P. Place system into normal operating service without system faults or outstanding work.

### 3.14 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve (12) months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Perform visual inspections at intervals required by NFPA 72 Chapter “Inspection, Testing, and Maintenance”.
  - 2. Perform tests at intervals required by NFPA 72 Chapter “Inspection, Testing, and Maintenance”.

### 3.15 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

### 3.16 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

END OF SECTION

H:\P2727.00\DOC\SPEC\2020\_01-17\_CAFE\_IFC\283111\_DIGITAL ADDRESSABLE FIRE ALARM.DOC