

**REQUEST FOR PROPOSALS
LCAO-RFP-2023-005
Leelanau County Government Center
Lower Level Environmental Health Department Space**



**Proposals Due
July 31, 2023
3:00 p.m.**

SUBMIT PROPOSALS TO:

**COUNTY OF LEELANAU
ADMINISTRATOR'S OFFICE
8527 E. GOVERNMENT CENTER DR., SUITE #101
SUTTONS BAY, MICHIGAN 49682**

PHONE (866) 256-9711

FAX (231) 256-0120

TABLE OF CONTENTS

Article		Page
ARTICLE I.	INTRODUCTION.....	1
Section 1.1	Purpose	1
Section 1.2	Background	1
Section 1.3	Minimum Qualifications	1
Section 1.4	Funding	2
Section 1.5	Period of Performance.....	2
ARTICLE II.	GENERAL INFORMATION FOR CONTRACTORS	2
Section 2.1	Project Administrator	2
Section 2.2	Estimated Schedule of Procurement Activities	2
Section 2.3	Submission of Proposals	3
Section 2.4	Proprietary Information and Public Disclosure	3
Section 2.5	Revisions to the RFP.....	3
Section 2.6	Acceptance Period	3
Section 2.7	Responsiveness.....	4
Section 2.8	Most Favorable Terms	4
Section 2.9	Costs of Proposal	4
Section 2.10	No Obligation Contract	4
Section 2.11	Rejection of Proposals and Reservation of Right to Negotiate	4
Section 2.12	Failure to Comply.....	4
Section 2.13	Commitment to Funds.....	4
Section 2.14	Signatures	4
Section 2.15	Prime Contractor Responsibilities	5
Section 2.16	Failure to Perform.....	5
Section 2.17	Non-Collusion Clause	5
Section 2.18	Withdrawal	5
Section 2.19	No RFP Response	5
ARTICLE III.	PROPOSAL CONTENT	5
Section 3.1	Proposal Submission	5
Section 3.2	Letter of Submittal.....	6
Section 3.3	Specifications	7
Section 3.4	Scope of Work.....	7
Section 3.5	Project Manager, Team Qualifications, Experiences and Requirements ...	7
Section 3.6	References	8
Section 3.7	Related Information.....	8
Section 3.8	Cost Proposal	8

Section 3.9	Identification of Anticipated and/or Potential Project Problems.....	9
Section 3.10	Acceptance of Conditions	9
ARTICLE IV.	CONTRACTUAL TERMS AND CONDITIONS.....	9
Section 4.1	Nondiscrimination.....	9
Section 4.2	Indemnification and Hold Harmless	10
Section 4.3	Contractor Insurance Requirements	10
Section 4.4	Applicable Law and Venue.....	10
Section 4.5	Compliance with the Law.....	10
Section 4.6	Assignments.....	10
Section 4.7	Independent Contractor	10
Section 4.8	Iran Linked Business.....	11
ARTICLE V.	EVALUATION AND CONTRACT AWARD	11
Section 5.1	Evaluation Procedure.....	11
EXHIBIT A	CERTIFICATIONS AND ASSURANCES	12
EXHIBIT B	BUSINESS ORGANIZATION	14
EXHIBIT C	CHECKLIST FOR RESPONSIVENESS	15
EXHIBIT D	CERTIFICATE OF COMPLIANCE WITH PUBLIC ACT 517 OF 2012 FORM.....	16
EXHIBIT E	TAX CERTIFICATION.....	17
EXHIBIT F	LEELANAU COUNTY BOARD POLICY ON INSURANCE REQUIREMENTS	18
EXHIBIT G	PROJECT MANUAL AND SPECIFICATIONS	21

REQUEST FOR PROPOSALS: LCAO-RFP-2023-005
Leelanau County Government Center
Lower Level Environmental Health Department Space
Quote Due Date: July 31, 2023 – 3:00 p.m.

The County of Leelanau (hereinafter referred to as the “County”) is seeking proposals from interested and qualified vendors experienced in building construction (hereinafter referred to as “Respondents”) for the purpose of the build out of the Lower Level of the Leelanau County Government Center located at 8527 E. Government Center Dr., Suttons Bay, Michigan, 49682 (hereinafter referred to as the “Work Location”).

I. INTRODUCTION

1.1 Purpose

The County initiated this Request for Proposals (hereinafter referred to as “RFP”) to solicit proposals from experienced Respondents interested in constructing the buildout of space for the Environmental Health Department at the Work Location. The RFP will allow the County to identify a qualified Respondent able to exercise appropriate skill and judgment; furnish efficient construction administration, management services, and supervision; furnish an adequate supply of workers and materials; and perform the desired work in an expeditious and economical manner consistent with the County’s interests (hereinafter referred to as the “Services”), as more fully set forth in the Project Manual and Specifications (Exhibit G). In responding to this RFP, Respondents must follow the prescribed format as outlined herein. The proposals should describe in detail the Respondent’s ability to provide the Services, while identifying the Leelanau County Board of Commissioners’ (hereinafter referred to as the “Board of Commissioners”) future financial obligations for such Services, as applicable.

1.2 Background

The Leelanau County Government Center is an existing structure located at the Work Location. This RFP is for the interior build out of approximately 2,711 square feet in the lower level of the Leelanau County Government Center to be used by the Benzie-Leelanau District Health Department, specifically the Environmental Health Office, consistent with the terms and conditions in the Project Manual and Specifications (Exhibit G).

1.3 Minimum Qualifications

The Respondent will be deemed non-responsive and rejected without any further evaluation if the Respondent does not meet the following minimum qualifications. Any deviations from these specifications, if fully explained in a letter, shall receive full consideration if they are in the best interest of the County.

- a) At least five (5) years of significant experience, competence and reputation of the persons assigned to provide the Service described in the Scope of Work;
- b) Satisfactory client references (as applicable);
- c) Pricing acceptable to the County; and
- d) Availability to service the needs of the County in a convenient and timely manner.

1.4 Funding

Payment in full shall be made at the completion of the project to the County’s satisfaction and processed through the County’s normal billing process. Any contract awarded as a result of this RFP is contingent upon the availability of funding, as determined by the Board of Commissioners.

1.5 Period of Performance

The period of performance of any contract resulting from this RFP is tentatively scheduled to begin upon award of and execution of a contract. The County wishes to enter into a six (6) month contract. The contract will include options to cancel in the event of fault or no fault.

II. GENERAL INFORMATION FOR CONTRACTORS

2.1 Project Administrator

The Project Administrator is the sole point of contact regarding this RFP. All communication between prospective proposers, Respondents, and the County upon receipt of this RFP shall be with the Project Administrator, as follows:

Fred Hackl
FAH Architecture, PLLC
891 W. Conway Rd., Unit #16
Harbor Springs, Michigan 49740
Telephone: (231) 881-8624
E-mail: f_hackl@yahoo.com

In preparing proposals, prospective proposers and Respondents are to rely only upon the contents of this RFP, accompanying documents, and any written statements issued by the Project Administrator. Any other communication will be considered unofficial and non-binding on the County. **THE COUNTY IS NOT RESPONSIBLE FOR ANY ORAL INSTRUCTIONS.** If a prospective proposer or Respondent find a discrepancy, error, or omission in the RFP, or require any written addendum thereto, the prospective proposer or Respondent is requested to notify the Project Administrator in writing, so that written clarification may be sent to all prospective proposers and Respondents. Communication directed to parties other than the Project Administrator may result in disqualification of the prospective proposer or Respondent.

2.2 Estimated Schedule of Procurement Activities

The County anticipates the following procurement schedule:

RFP Released	June 23, 2023	
Site Visit/Walk Through.....	July 19, 2023	10:00 a.m. (EDT)
Questions Due to Administration.....	July 21, 2023	5:00 p.m. (EDT)
Questions Responses.....	July 24, 2023	
Intent to Bid.....	July 27, 2023	
Proposals Due.....	July 31, 2023	3:00 p.m. (EDT)
Notice of Award.....	August 16, 2023	

2.3 Submission of Proposals

Respondents are required to submit three (3) copies of their proposal. One (1) copy must have original signatures and the other copies can have photocopied signatures. Each copy of the proposal should be bound or contained in a single volume. All documentation submitted with the proposal should be contained in that single volume. The proposal, whether mailed or hand delivered, must arrive at the County Administration Office no later than 3:00 p.m., local time, on July 31, 2023.

The proposal is to be sent to Project Administrator at the address noted in Section 2.1, above. The envelope submitted should be clearly marked **“LEELANAU COUNTY GOVERNMENT CENTER LOWER LEVEL PROJECT”** and addressed to the attention of the Project Administrator.

Respondents who mail proposals should allow normal mail delivery time to ensure timely receipt of their proposals by the Project Administrator. Respondents assume the risk for the method of delivery chosen. The County assumes no responsibility for delays caused by any delivery service. ***Proposals may not be transmitted using electronic media such as facsimile transmission or electronic mail.***

Late proposals will not be accepted and will be automatically disqualified from further consideration. All proposals and any accompanying documentation become the property of the County and will not be returned. The opening and reading of a proposal does not constitute the County’s acceptance of the Respondent as a responsive and responsible Respondent.

Respondents are requested to be brief in response. The inclusion of extraneous information beyond the description of service and project approach and information specifically required by this RFP is discouraged. Submission of a proposal establishes a conclusive presumption that the Respondent is thoroughly familiar with the RFP and specifications and terms of Article IV, and that the Respondent understands and agrees to abide by each and all of the stipulations and requirements contained therein.

2.4 Proprietary Information and Public Disclosure

Materials submitted in response to this RFP shall become the property of the County. All proposals received shall remain confidential until the deadline for submission of proposals has expired, as defined by Michigan statute (MCL 15.243(i)), the Freedom of Information Act.

2.5 Revisions to the RFP

In the event it becomes necessary to revise any part of this RFP, addenda will be reduced to writing and submitted to all prospective proposers and Respondents known to the County. For this purpose, the published questions and answers and any other pertinent information will be considered an addendum to the RFP and will be provided to prospective proposers. All such changes or addenda shall become part of the contract and all prospective proposers and Respondents shall be bound by such changes and addenda. The County reserves the right to cancel or to reissue the RFP in whole or in part, prior to execution of a contract.

2.6 Acceptance Period

Respondents must provide ninety (90) calendar days for acceptance by the County from the due date for receipt of proposals.

2.7 Responsiveness

All proposals will be reviewed by the Project Administrator to determine compliance with administrative requirements and instructions specified in this RFP. Failure to comply with any part of the RFP may result in rejection of the proposal as non-responsive. The County also reserves the right, at its sole discretion, to waive minor administrative irregularities.

2.8 Most Favorable Terms

The County reserves the right to make an award without further discussion of the proposal submitted. Therefore, the proposal should be submitted initially on the most favorable terms which the Respondent can propose. The County does reserve the right to contact a Respondent for clarification of its proposal. The Respondent should be prepared to accept this RFP for incorporation into a contract resulting from this RFP. Contract negotiations may incorporate some or the Respondent's entire proposal. It is understood that the proposal will become a part of the official procurement file on this matter without obligation to the County.

2.9 Costs of Proposal

The County will not be liable for any costs incurred by the Respondent in preparation of a proposal submitted in response to this RFP, in conduct of a presentation, or any other activities related to responding to this RFP.

2.10 No Obligation Contract

This RFP does not obligate the Board of Commissioners to award a contract for services specified herein.

2.11 Rejection of Proposals and Reservation of Right to Negotiate

The County reserves the right at its sole discretion to reject any and all proposals received without penalty and not to issue a contract as a result of this RFP. The County also reserves the right to waive any informalities or irregularities in proposals, and/or negotiate separately the terms and conditions of all or any part of the proposals as deemed to be in the County's best interests at its sole discretion even though not the lowest cost. No proposal shall be accepted from any party who is in default on the payment of taxes or other liability due the County.

2.12 Failure to Comply

The Respondent is specifically notified that failure to comply with any part of the RFP may result in rejection of the proposal as non-responsive.

2.13 Commitment of Funds

The Board of Commissioners or its delegate(s) are the only individuals who may legally commit the County to the expenditure of funds for a contract resulting from this RFP. No cost chargeable to the proposed contract may be incurred before receipt of a fully executed contract.

2.14 Signatures

The Letter of Submittal and the Certifications and Assurances form must be signed and dated by a person authorized to legally bind the Respondent to a contractual relationship, e.g., the President or Executive Director of a corporation, the managing partner of a partnership, or the proprietor of a sole proprietorship.

2.15 Prime Contractor Responsibilities

The Respondent, whose proposal is accepted by the County, will be required to assume responsibility for all services offered in the proposal regardless of whether or not they possess them within their organization or will be provided by a subcontractor. Furthermore, the County will consider the successful Respondent to be the sole point of contact with regard to contractual matters, including payment of any and all charges resulting from the contract. All prices quoted by the Respondent shall be FOB.

2.16 Failure to Perform

For failure to deliver or perform in accord with the accepted bid, the County may consider the Respondent in default and take steps to protect the County's interest. The County may, if applicable and without impairing its other rights and benefits, purchase all or part of the contract goods or services on the open market and charge any additional costs to the contractor or their surety.

2.17 Non-Collusion Clause

By signing and submitting this bid, the Respondent states that Respondent's proposal is genuine and not collusive or sham; such Respondent has not colluded, conspired, connived, or agreed, directly or indirectly, with any other Respondent or person, to put in a sham bid, or that such other person will refrain from proposing and has not in any manner, directly or indirectly, colluded, conspired, connived, or agreed, with any person, to fix the price of affiant or any other proposer, or to fix any overhead, profit or cost element of said bid price.

2.18 Withdrawal

Proposals may only be withdrawn by written notice prior to the date and time set for the opening of proposals. No proposal may be withdrawn after the deadline for submission.

2.19 No RFP Response

Respondents who receive this RFP by invitation, but who do not submit a proposal, are requested to return a notice stating the reason(s) for not responding.

III. PROPOSAL CONTENT

3.1 Proposal Submission

Proposals must be submitted on eight and one-half by eleven (8¹/₂ x 11) inch paper, separated into nine (9) major sections. The nine (9) major sections shall include:

- a) Letter of Submittal, including signed Certifications and Assurances (Exhibit A of this RFP);
- b) Project Manager and Team Qualifications, Experiences and Requirements;
- c) References;
- d) Related Information and History;
- e) Cost Proposal and Compensation;
- f) Identification of Anticipated and/or Potential Project Problems;

- g) Signed Certificate of Compliance with Public Act 517 of 2012 Form (Exhibit D of this RFP);
- h) Acceptance of Conditions; and
- i) Completed Checklist for Responsiveness (Exhibit C of this RFP).

Proposals must provide information in the same order as presented in this document with the same headings. This will not only be helpful to the evaluators of the proposal, but should assist the Respondent in preparing a thorough response. Proposals must be enclosed in a sealed envelope, box or package, and clearly marked on the outside with the following: RFP title, deadline, and Respondent's name; address; phone; fax, if applicable; electronic mail address; and contact name.

3.2 Letter of Submittal

The Letter of Submittal, the attached Certifications and Assurances form (See Exhibit A), and all RFP amendments must be signed and dated by a person authorized to legally bind the Respondent to a contractual relationship, e.g., the President or Executive Director of a corporation, the managing partner of a partnership, or the proprietor of a sole proprietorship. Along with introductory remarks, the Letter of Submittal is to include by attachment the following information about the Respondent and any proposed subcontractors:

- a) Full official legal name of Respondent's firm.
- b) Names; addresses; telephone numbers; e-mail addresses; and fax numbers, if applicable, of legal entity or individual with whom contract would be written.
- c) Name, address, and telephone number of each principal officer(s) (President, Vice President, Treasurer, Executive Director, partners, owner of sole proprietorship).
- d) Legal status of the Respondent (sole proprietorship, partnership, corporation, LLC, etc.) and the year the entity was organized to do business as the entity now substantially exists.
- e) Federal Employer Tax Identification number or Social Security number.
- f) Location of the facility from which the Respondent would operate.
- g) Identify any County employees or former County employees employed or on the firm's governing board as of the date of the proposal. Include their position and responsibilities within the Respondent's organization. If following a review of this information, it is determined by the County that a conflict of interest exists, the Respondent may be disqualified from further consideration for the award of a contract.
- h) A representation that the Respondent is in good standing in the State of Michigan and in the state in which it is located and will have all necessary licenses, permits, certifications, approvals and authorizations necessary to perform all of its obligations in connection with this RFP.

3.3 Specifications

Through this RFP, the County hereby invites Respondents that meet the qualifications set forth herein to submit proposals regarding the County's approximate Service needs and to determine the feasibility of the Leelanau County Government Center Lower Level Project.

3.4 Scope of Work

This RFP is being issued to address the buildout of the Leelanau County Government Center Lower Level, consistent with the Project Manual and Specifications (Exhibit G). The successful Respondent will be responsible for the following:

- a) Providing a schedule from start to completion of the Services. This must be included with the Respondent's proposal and shall include the length of time required to complete the Services. The Services must be completed in a timely and professional manner and protect the structure from all weather for the duration of the project.
- b) Assuming responsibility for job safety, equipment, labor and means to perform the Services. The successful Respondent shall conform to all local, state, and federal regulations;
- c) Taking all field measurements and inspecting the Work Location as necessary to provide an accurate quote to complete the Services. The Respondent shall have **SOLE** responsibility for accuracy of all measurements, estimates of material quantities and sizes, and site conditions that will affect the Services. All materials must be specified as part of the proposal. The County will pay no additional charges.
- d) Providing all ladders, lifts, and any other equipment necessary to perform the Services;
- e) Removing and disposing of all job-related debris and performing a final job site clean up to the satisfaction of the County at the end of the project at the successful Respondent's own expense, include, but not limited to, completing a meticulous clean up and disposal of all waste materials.

3.5 Project Manager and Team Qualifications, Experiences and Requirements

Proposals shall include a complete list of and resumes for all key personnel and management that would be performing the work required in this RFP. All designated personnel and management must be based at an office located within fifty (50) miles of the Leelanau County Government Center to be considered. All designated personnel and management who will be working with the County will be required to complete free on-line Criminal Justice Information Services (hereinafter referred to as "CJIS") training and undergo a background check per CJIS requirements at the County's expense.

For each person on the list, the following information shall be included:

- a) The person's relationship with Respondent, including job title and years of employment with Respondent;
- b) The role that the person will play in connection with the RFP;
- c) Address; telephone; fax numbers, if applicable; and e-mail address;

- d) The person's educational background;
- e) The person's relevant experience; and
- f) Relevant awards, certificates or other achievements.

This section of the proposal should include no more than two (2) pages of information for each listed person.

3.6 References

Proposals must list names; addresses; telephone numbers; e-mail addresses; and fax numbers, if applicable, of three (3) references located within a fifty (50) mile radius of the County for whom similar work has been accomplished and briefly describe the type of service provided. ***References should be from projects that had similar scope, volume and requirements to those outlined in this RFP. Additional references shall be provided if requested by the County.*** The Respondent must grant permission to the County to contact the references. Do not include current County staff as references.

3.7 Related Information

Proposals must include the following information:

- a) If the Respondent or any subcontractor contracted with the County since January 1, 2016, provide a project description and/or other information available to identify the contract.
- b) If the Respondent's staff or subcontractor's staff was an employee of the County during the past twenty-four (24) months, or is currently a County employee, identify the individual by name, the department previously or currently employed by, job title or position held and separation date.
- c) If the Respondent has had a contract terminated for default in the last five (5) years, describe such incident. Termination for default is defined as notice to stop performance due to the Respondent's non-performance or poor performance and the issue of performance was either (a) not litigated due to inaction on the part of the Respondent, or (b) litigated and such litigation determined that the Respondent was in default.
- d) Submit full details of the terms for default including the other party's name, address, and phone number. Present the Respondent's position on the matter. The County will evaluate the facts and may, at its sole discretion, reject the proposal on the grounds of the past experience. If no such termination for default has been experienced by the Respondent in the past five (5) years, so indicate.

3.8 Cost Proposal

The evaluation process is designed to award this procurement not necessarily to the Respondent of least cost, but rather to the Respondent whose proposal best meets the requirements of this RFP. The County reserves the rights set forth in Section 2.11 of this RFP.

Identify all costs including expenses to be charged for performing the Services necessary to accomplish the objectives of the contract. The Respondent is to submit a fully detailed budget including staff costs

and any expenses necessary to accomplish the tasks and to produce the deliverables under the contract. Please note that the County is exempt from all taxes.

Costs for subcontractors are to be broken out separately.

3.9 Identification of Anticipated and/or, Potential Project Problems

Use this section of the proposal to identify and describe any anticipated and/or potential project problems, the Respondent's approach to resolving these problems, and any special assistance that will be requested from the County.

3.10 Acceptance of Conditions

Provide a definitive statement of intent to comply with the Contractual Terms and Conditions as delineated in this RFP. If proposed terms and conditions are not acceptable as described, note and explain any exceptions; however, failure to agree to the terms required by law or County purchasing and contractual requirements may be grounds for disqualification of the proposal.

IV. CONTRACTUAL TERMS AND CONDITIONS

Any contract arising out of this RFP shall contain provisions that include, but will not be limited to, the following:

4.1 Nondiscrimination Clause

The Respondent who is selected as the Contractor, as required by law, shall not discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions or privilege of employment, or a matter directly or indirectly related to employment because of race, color, religion, sex, national origin, disability that is unrelated to the individual's ability to perform the duties of a particular job or position, height, weight, marital status, age or political affiliation.

The Contractor shall adhere to all applicable Federal, State and local laws, ordinances, rules and regulations prohibiting discrimination, including, but not limited to, the following:

- a) The Elliott-Larsen Civil Rights Act, 1976 PA 453, as amended.
- b) The Persons with Disabilities Civil Rights Act, 1976 PA 220, as amended.
- c) Section 504 of the Federal Rehabilitation Act of 1973, P.L. 93-112, 87 Stat. 355, as amended, and regulations promulgated there under.
- d) The Americans with Disabilities Act of 1990, P.L. 101-336, 104 Stat 327 (42 USC §12101 et seq.), as amended, and regulations promulgated there under.

Breach of this section shall be regarded as a material breach of the agreement.

4.2 Indemnification and Hold Harmless

The Respondent who is selected as the Contractor shall, at its own expense, protect, defend, indemnify, save and hold harmless the County of Leelanau and its elected and appointed officers, employees, servants

and agents from all claims, damages, lawsuits, costs and expenses including, but not limited to, all costs from administrative proceedings, court costs and attorney fees that the County of Leelanau and its elected and appointed officers, employees, servants and agents may incur as a result of any violations of federal or State of Michigan laws, codes, rules or regulations, willful or wanton misconduct, or negligent acts or omissions of the Contractor or its employees, servants, agents or Subcontractors that may arise out of the agreement.

The Contractor's indemnification responsibility under this section shall include the sum of damages, costs and expenses which are in excess of the sum of damages, costs and expenses which are paid out on behalf of or reimbursed to the County, its officers, employees, servants and agents by the insurance coverage obtained and/or maintained by the Contractor.

4.3 Contractor Insurance Requirements

The Respondent who is selected as the Contractor shall, at all times during the term of this Agreement, maintain insurance that meets the requirements of Leelanau County's Board of Commissioners Policy on "Insurance Requirements." A copy of said Board Policy shall be attached to this Agreement labeled as an Exhibit. The attached Exhibit will be incorporated by reference into this Agreement and shall be made a part thereof. (See Exhibit F).

4.4 Applicable Law and Venue

Any agreement resulting from this RFP shall be subject to and construed according to the laws of the State of Michigan. The County and the Respondent who is selected as the Contractor agree that the venue for any legal or equity action under this agreement shall be in Michigan Courts whose jurisdiction and venue shall be established in accordance with the statutes and Court Rules of the State of Michigan. In the event that any action is brought under any agreement resulting from the RFP in Federal Court, the venue for such action shall be the Federal Judicial District of Michigan, Western District - Southern Division.

4.5 Compliance with the Law

The Respondent who is selected as the Contractor shall render the services to be provided pursuant to this Agreement in compliance with all applicable Federal, State, and local laws, ordinances, rules, and regulations.

4.6 Assignments

The Respondent who is selected as the Contractor shall not assign the award of the contract or any payment without the prior written approval of the County.

4.7 Independent Contractor

The Respondent who is selected as the Contractor shall be an independent contractor. The employees, servants and agents of the Contractor shall not be deemed to be and shall not hold themselves out as employees, servants, or agents of the County and shall not be entitled to any fringe benefits received by the County's personnel, such as, but not limited to, health and accident insurance, life insurance, longevity or paid sick or vacation leave.

The Contractor shall be responsible for paying all compensation to its personnel for services they have performed under this Contract and for withholding and payment of all applicable taxes to the proper Federal, State and local governments.

4.8 Iran Linked Business

The Respondent who is selected as Contractor shall certify to the County that neither it nor any of its successors, parent companies, subsidiaries, or companies under common ownership or control of the Contractor, are an "Iran Linked Business" engaged in investment activities of \$20,000,000.00 or more with the energy sector of Iran, within the meaning of Michigan Public Act 517 of 2012. It is expressly understood and agreed that the Contractor shall not become an "Iran linked business" during the term of this Agreement.

NOTE: IF A PERSON OR ENTITY FALSELY CERTIFIES THAT IT IS NOT AN IRAN LINKED BUSINESS AS DEFINED BY PUBLIC ACT 517 OF 2012, IT WILL BE RESPONSIBLE FOR CIVIL PENALTIES OF NOT MORE THAN \$250,000.00 OR TWO TIMES THE AMOUNT OF THE CONTRACT FOR WHICH THE FALSE CERTIFICATION WAS MADE, WHICHEVER IS GREATER, PLUS COSTS OF INVESTIGATION AND REASONABLE ATTORNEY FEES INCURRED, AS MORE FULLY SET FORTH IN SECTION 5 OF ACT NO. 517, PUBLIC ACTS OF 2012.

V. EVALUATION AND CONTRACT AWARD

5.1 Evaluation Procedure

This document is a RFP. As a result of this RFP, the County expects to receive and evaluate proposals and select a qualified service provider. As such, the lowest price proposal will not guarantee an award. Proposals will be evaluated based around features of service, qualifications, experience, timeliness and what is determined by the Board of Commissioners to be the best solution for the County. The County may also consider the past performance of the Respondent on other contracts with the County or other entities.

The County may select a limited number of Respondents with whom to schedule interviews. Recommendation for a selection will be made to the Board of Commissioners and final approval lies with the Board of Commissioners.

Responsive proposals will be evaluated strictly in accordance with the requirements stated in this solicitation and any addenda issued. All proposals received by the stated deadline will be reviewed by the Project Administrator to ensure that Respondents meet all minimum requirements. Respondents that fail to meet stated qualifications or any proposal that does not contain all of the required information will be rejected as non-responsive. The County reserves the right to make such additional investigations as it deems necessary and may require the submission of additional information.

EXHIBIT A

CERTIFICATIONS AND ASSURANCES

THIS FORM MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL. FAILURE TO SUBMIT THIS COMPLETED FORM MAY RESULT IN DISQUALIFICATION.

TO: Leelanau County Administration
8527 E. Government Center Dr.
Suite #101
Suttons Bay, MI 49682

FROM: Vendor: _____
Address: _____
County, State, Zip Code: _____
Contact Person: _____
Telephone Number: _____
Fax Number: _____
E-Mail address: _____
FEIN #: _____
Project Name: _____

I/we, _____, make the following statement of assurances as a required element of the proposal to which it is attached, understanding that the truthfulness of the facts affirmed here and the continuing compliance with these requirements are conditions precedent to the award or continuation of the related contract(s):

1. The prices and/or data have been determined independently, without consultation, communication, or agreement with other proposers for the purpose of restricting competition. However, I/we may freely join with other persons or organizations for the purpose of presenting a single proposal.
2. The attached proposal is a firm offer for a period of one hundred twenty (120) calendar days following receipt, and it may be accepted by the Leelanau County without further negotiation (except where obviously required by lack of certainty in key terms) at any time within the one hundred twenty (120) calendar day period.
3. In preparing this proposal, I/we have not been assisted by any current or former employee of Leelanau County whose duties relate (or did relate) to this proposal or prospective contract, and who was assisting in other than his or her official, public capacity. Neither does such a person nor

any member of his or her immediate family have any financial interest in the outcome of proposal. (Any exceptions to these assurances are described in full detail on a separate page and attached to this document.)

4. I/we understand that Leelanau County will not reimburse me/us for any costs incurred in the preparation of this proposal. All proposals become the property of Leelanau County, and I/we claim no proprietary right to the ideas, writings, items, or samples, unless so stated in this proposal.
5. Unless otherwise required by law, the prices and/or cost data which have been submitted have not been knowingly disclosed by the proposer and will not knowingly be disclosed by him/her prior to opening, in the case of a proposal directly or indirectly to any other proposer or to any competitor.
6. No attempt has been made or will be made by the proposer to induce any other person or firm to submit or not to submit a proposal for the purpose of restricting competition.
7. I/we agree that submission of the attached proposal constitutes acceptance of the solicitation contents and the attached sample contract and general terms and conditions. If there are any exceptions to these terms, I/we have described those exceptions in detail on a page attached to this document.
8. I/we acknowledge communication of any kind regarding my/our proposal directed to parties other than the Project Administrator may result in my/our disqualification.
9. I/we warrant that no conflict of interest knowingly exists for any member of the project team that contributed to this proposal or prospective contract.

Signature

Date

Printed Name/Title

EXHIBIT B

BUSINESS ORGANIZATION

THIS FORM MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL. FAILURE TO SUBMIT THIS COMPLETED FORM MAY RESULT IN DISQUALIFICATION.

- Sole Proprietor:** An individual whose signature is affixed to this proposal.
- Partnership:** Attach sheet and state full names, titles and address of all responsible principals and/or partners. Provide percent of ownership and a copy of partnership agreement.
- Corporation:** State of incorporation: _____
Provide a disclosure of all officers and principals by name and business address, date of incorporation and indicate if the corporation is authorized to do business in Michigan.
- LLC:** Organized under the State of _____. Provide a disclosure of all officers and principals by name and business address, date of establishment and indicate if the LLC is authorized to do business in Michigan.

In submitting this proposal, it is understood that the County reserve the right to reject any or all proposals, to accept an alternate proposal, and to waive any informalities in any proposal.

In compliance with your Request for Proposals, and subject to all conditions thereof, the undersigned offers and agrees, if this proposal is accepted, to furnish the services as outlined.

Business Name *(Corporate Seal)*

Authorized Signature Print or type name

Title Date

EXHIBIT C

CHECKLIST FOR RESPONSIVENESS

___ Proposal was submitted on or before 3:00 p.m., local time, on July 31, 2023.

___ Required number of proposal copies were submitted.

___ Proposal was formatted into eight major sections: Letter of Submittal, including a signed Certifications and Assurances; Project Manager and Team Qualifications, Experiences and Requirements; References; Related Information and History; Cost Proposal and Compensation; Identification of Anticipated and/or Potential Project Problems; Signed Certificate of Compliance with Public Act 517 of 2012 Form; and Acceptance of Conditions.

___ Respondent meets minimum qualifications:

1. Licensed to do business in the State of Michigan.
2. Will comply with the Certificate of Assurances set forth in Exhibit A.
3. Has certified that it is not an Iran Linked Business.
4. Submit proposals as specified in this RFP.

___ Letter of Submittal and Certifications and Assurances were signed by an individual authorized to bind the Proposer to a contractual relationship, e.g., the President or Executive Director of a corporation, the managing partner of a partnership, or the sole proprietor of a sole proprietorship.

___ Three (3) references from three (3) previous clients provided.

NOTE: "Yes" answers must be given to each element above for the proposal to be considered responsive.

(Name of Company)

By: _____

Date: _____

Title: _____

EXHIBIT D

CERTIFICATE OF COMPLIANCE WITH PUBLIC ACT 517 OF 2012 FORM

THIS FORM MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL. FAILURE TO SUBMIT THIS COMPLETED FORM MAY RESULT IN DISQUALIFICATION.

(Please type or print clearly in ink only)

I certify that neither _____ (Company), nor any of its successors, parent companies, subsidiaries, or companies under common control, is an “Iran Linked Business” engaged in investment activities of \$20,000,000.00 or more with the energy sector of Iran, within the meaning of Michigan Public Act 517 of 2012. In the event it is awarded a Contract as a result of this solicitation, Company will not become an “Iran linked business” during the course of performing the work under the Contract.

NOTE: IF A PERSON OR ENTITY FALSELY CERTIFIES THAT IT IS NOT AN IRAN LINKED BUSINESS AS DEFINED BY PUBLIC ACT 517 OF 2012, IT WILL BE RESPONSIBLE FOR CIVIL PENALTIES OF NOT MORE THAN \$250,000.00 OR TWO TIMES THE AMOUNT OF THE CONTRACT FOR WHICH THE FALSE CERTIFICATION WAS MADE, WHICHEVER IS GREATER, PLUS COSTS AND REASONABLE ATTORNEY FEES INCURRED, AS MORE FULLY SET FORTH IN SECTION 5 OF ACT NO. 517, PUBLIC ACTS OF 2012.

(Name of Company)

By: _____

Date: _____

Title: _____

EXHIBIT E

TAX CERTIFICATION

THIS FORM MUST BE COMPLETED AND RETURNED WITH YOUR PROPOSAL. FAILURE TO SUBMIT THIS COMPLETED FORM MAY RESULT IN DISQUALIFICATION.

I, _____, having been first duly sworn depose and state as follows:

I, _____, am the duly authorized

agent for _____, which has

submitted a proposal to the County for

_____ and I hereby certify

(Name of Project)

that _____ is not delinquent in the payment of any tax administered by the Michigan Department of Revenue, or if it is:

a. it is contesting its liability for the tax or the amount of tax in accordance with procedures established by the appropriate Revenue Act; or

b. it has entered into an agreement with the Department of Revenue for payment of all taxes due and is currently in compliance with that agreement.

By: _____

Title: _____

Subscribed and Sworn to
before me this _____
day of _____, 20__

EXHIBIT F

LEELANAU COUNTY BOARD POLICY

GENERAL SUBJECT:	Administration/General (County Administrator)	Policy No.	13
SPECIFIC SUBJECT:	Insurance Requirements Policy	Adopted:	04/17/1990
		Revised:	02/15/1994
		Revised:	05/21/2013
		Revised:	12/19/2017

APPLIES TO: All Leelanau County Employees and Elected Officials.

PURPOSE: The Leelanau County Board of Commissioners hereby establishes a policy on insurance requirements for contractors, vendors, individuals, and/or organizations receiving monies from Leelanau County. The purpose of these requirements is to assure that the parties referenced above are accepting appropriate responsibility for ensuring their own operations, and that they are not unduly exposing Leelanau County taxpayers to liability and/or loss.

The Contractor, and any and all of their subcontractors, shall not commence any work until they have met the insurance requirements outlined in this policy. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan. All coverages shall be with insurance carriers acceptable to Leelanau County and have a minimum A.M. Best Company (www.ambest.com) Insurance Report rating of not less than A or A- (Excellent).

1. Workers' Compensation Insurance: The Contractor shall procure and maintain during the life of the contract, Workers' Compensation Insurance, including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan. Workers' Compensation and Employers' Liability Insurance are required if the party hires one or more persons or currently has employees. If a party currently does not have any employees, and is a sole proprietor, an affidavit must be filed with the County Clerk stating that the party currently has no employees and will not hire any while working for Leelanau County as a contractor or a subcontractor, etc. If a party currently does not have any employees and is incorporated (Inc.) or a limited liability corporation (LLC), they must file a Notice of Exclusion, WC-337, with the State of Michigan and then provide a copy of the State-approved document to the County Clerk.

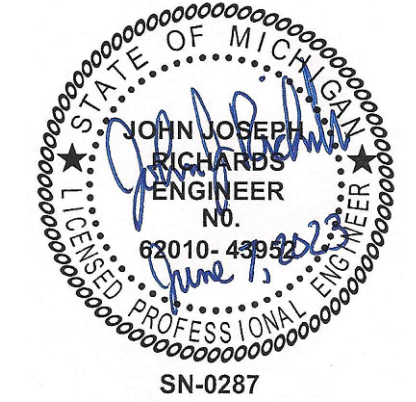
2. Contractor's Tools & Equipment: The Contractor shall be responsible for insuring all its tools, equipment and materials which it may leave at the Project's work site. The County shall not be responsible for any loss or damage to the Contractor's tools, equipment and materials.
3. Professional Liability (Errors and Omissions) Insurance: [For contracts for professional services, e.g., Architect, Engineers, Doctors, Dentist, etc.] The Contractor shall possess Professional Liability Insurance (errors and omissions) with limits of not less than \$1,000,000.00 per occurrence or claim. If the Professional Liability Insurance is on a claims-made basis, the Contractor shall purchase extended reporting period "tail" coverage for a minimum of three (3) years after termination of the Agreement.
4. Commercial General Liability Insurance: The Contractor shall procure and maintain during the life of their contract, Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than \$1,000,000.00 per occurrence and aggregate combined single limit, Personal Injury, Bodily Injury, and Property Damage. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent; (E) Deletion of all Explosion, Collapse, and Underground (XCU) Exclusions, if applicable.
5. Motor Vehicle Liability: The Contractor shall procure and maintain during the life of their contract Motor Vehicle Liability Insurance, including Michigan No-Fault Coverage, with limits of liability not less than \$1,000,000.00 per occurrence combined single limit, Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.
6. Deductibles: The Contractor shall be responsible for paying all deductibles in its insurance coverages.
7. Additional Insured: Commercial General Liability and Motor Vehicle Liability Insurance, as described above, shall include an endorsement stating that the following shall be Additional Insureds: Leelanau County, all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and board members, including employees and volunteers thereof. The Contractor's insurance coverages shall be primary to the Additional Insureds and not contributing with any other insurance or similar protection available to the Additional Insureds, regardless of whether said other available coverage be primary, contributing or excess.
8. Cancellation Notice: Workers' Compensation Insurance, Commercial General Liability Insurance, and Motor Vehicle Liability Insurance, as described above, shall include an endorsement stating the following: "It is understood and agreed that Thirty (30) days Advance Written Notice of Cancellation, Non-Renewal, Reduction, and/or Material Change shall be sent to the office of the Leelanau County Administrator.

9. Owners' and Contractors' Protective Liability: [For Contracts for Construction or Large Repair or Maintenance Projects such as road work, sewer work or building projects] The Contractor shall procure and maintain during the life of the contract, a separate Owners' and Contractors' Protective Liability Policy with limits of liability not less than \$1,000,000.00 per occurrence and aggregate combined single limit, Personal Injury, Bodily Injury, and Property Damage. Leelanau County shall be "Named Insured" on said coverage. Thirty (30) day Notice of Cancellation shall apply to this policy.
10. Proof of Insurance Coverage: The Contractor shall provide Leelanau County at the time that the contracts are returned by him/her for execution, A "Certificate of Liability Insurance," on Accord Form #25, with the necessary coverages included, as listed below:
 - a. Certificate of Insurance for Workers' Compensation Insurance;
 - b. Certificate of Insurance for Commercial General Liability Insurance;
 - c. Certificate of Insurance for Vehicle Liability Insurance;
 - d. Certificate of Insurance for Professional Liability Insurance on Projects where such insurance is required.
 - e. Original Policy, or original Binder pending issuance of policy, for Owners' & Contractors' Protective Liability Insurance, where such insurance is required.
 - f. If so requested, Certified Copies of all policies mentioned above will be furnished.
11. If any of the above coverages expire during the term of the contract, the Contractor shall deliver renewal certificates and/or policies to the Leelanau County Administrator at least ten (10) days prior to the expiration date.

Failure to comply with these insurance requirements could result in the termination of a contract or delay in receipt of funds. Questions regarding the scope of applicability of this policy may be directed to the Leelanau County Administrator.

EXHIBIT G

PROJECT MANUAL AND SPECIFICATIONS



PANEL A (STORAGE 11) 100 AMPS M.L.O. 120/208V-3P-4W

CR NO.	AMP/POLES	DESCRIPTION	LOAD	LOAD	DESCRIPTION	AMP/POLES	CR NO.
1	20/1	LIGHTS (N. OFFICES/MEETING RM)	680	544	LIGHTS (W. OFFICES)	20/1	2
3	20/1	LIGHTS (STOR/LOBBY/RR)	476	782	LIGHTS (MECH RM 1060)	20/1	4
5	20/1	RECEPTACLES (MEETING RM 9)	900	720	RECEPTACLES (OFFICE 8)	20/1	6
7	20/1	RECEPTACLES (OFFICE 7)	720	720	RECEPTACLES (OFFICE 6)	20/1	8
9	20/1	POWER-POLE (JB) (OFFICE 3)	1000	1000	POWER-POLE (JB) (OFFICE 2)	20/1	10
11	20/1	POWER-POLE (JB) (OFFICE 1)	1000	1000	POWER-POLE (JB) (ADMIN. ASSISTANT 2)	20/1	12
13	20/1	RECEPTACLES (OFFICE OPEN AREA 10)	540	900	RECEPTACLES (OFFICE OPEN AREA 10)	20/1	14
15	20/1	RECEPTACLES (STORAGE 11)	360	360	RECEPTACLES (LOBBY 1)	20/1	16
17	20/1	RECEPTACLES (RESTROOM 12)	180	1080	RECEPTACLES (FRONT OFFICE 1020)	20/1	18
19	20/1	VAV POWER MODULE (MEETING RM 9)	250	540	RECEPTACLES (ADMIN. ASSISTANT 2)	20/1	20
21	20/1	WAP (OFFICE OPEN AREA 10)	250	---	SPARE	20/1	22
23	20/1	SPARE	---	---	SPACE	---	24
25	---	SPACE	---	---	SPACE	---	26
27	---	SPACE	---	---	SPACE	---	28
29	---	SPACE	---	---	SPACE	---	30
31	---	SPACE	---	---	SPACE	---	32
33	---	SPACE	---	---	SPACE	---	34
35	---	SPACE	---	---	SPACE	---	36
37	---	SPACE	---	---	SPACE	---	38
39	---	SPACE	---	---	SPACE	---	40
41	---	SPACE	---	---	SPACE	---	42

EXT'G PANEL SBLL 125 AMPS M.C.B. 277/480V-3P-4W

CR NO.	AMP/POLES	DESCRIPTION	LOAD	LOAD	DESCRIPTION	AMP/POLES	CR NO.
1	---	---	---	---	SPARE	20/1	2
3	---	EXT'G PUMPS 1-2,3,4	---	---	EXT'G HP-001, 004, 005	---	4
5	---	---	---	---	SPARE	---	6
7	---	---	---	---	---	---	8
9	---	EXT'G PUMPS 5,6	---	---	EXT'G HP-008	---	10
11	---	---	---	---	---	---	12
13	---	---	---	---	EXT'G CUH-001	---	14
15	---	EXT'G XF-SBLLA	---	---	EXT'G CUH-002	---	16
17	---	---	---	---	EXT'G CUH-003	---	18
19	---	EXT'G SHOWER RM. LIGHTS	---	1788	---	---	20
21	---	SPACE	---	1788	HP-019	20/3	22
23	---	SPACE	---	1788	---	---	24
25	---	SPACE	---	---	SPACE	---	26
27	---	SPACE	---	---	SPACE	---	28
29	---	SPACE	---	---	SPACE	---	30

EXT'G PANEL NPLLA 200 AMPS M.C.B. 120/208V-3P-4W

CR NO.	AMP/POLES	DESCRIPTION	LOAD	LOAD	DESCRIPTION	AMP/POLES	CR NO.
1	20/1	EXT'G LIGHTING MEETING ROOM	---	---	EXT'G LIGHTING MEETING ROOM	20/1	2
3	20/1	EXT'G LIGHTING MEETING ROOM	---	---	EXT'G LIGHTING MEETING ROOM	20/1	4
5	20/1	EXT'G GENERATOR BLOCK HEATER	---	---	EXT'G RECEPTACLES OFFICE 1017	20/1	6
7	20/1	EXT'G RECEPTACLES STOR 1019	---	---	EXT'G RECEPTACLES STOR 1021	20/1	8
9	20/1	EXT'G RECEPTACLES OFF 1016	---	---	EXT'G GENERATOR BATT. CHARGER	20/1	10
11	20/1	EXT'G RECEPTACLES WORK SHOP	---	---	EXT'G RECEPTACLES ROOM	20/1	12
13	20/1	EXT'G RECEPTACLES CORR 1024	---	---	EXT'G RECEPTACLES BATH 1041	20/1	14
15	20/1	EXT'G RECEPTACLES CORR 1013	---	---	EXT'G RECEPTACLES FUTURE 1001	20/1	16
17	20/1	EXT'G RECEPTACLES MAIL ROOM	---	---	EXT'G RECEPTACLES BREAK ROOM	20/1	18
19	20/1	EXT'G RECEPTACLES KITCHEN 1004	---	---	EXT'G RECEPTACLES KITCHEN 1004	20/1	20
21	20/1	EXT'G RECEPTACLES KITCHEN 1004	---	---	EXT'G RECEPTACLES KITCHEN 1004	20/1	22
23	20/1	EXT'G RECEPTACLES KITCHEN 1004	---	---	EXT'G RECEPTACLES KITCHEN 1004	20/1	24
25	20/1	EXT'G RECEPTACLES MEETING ROOM	---	---	EXT'G PROJECTOR CKT. MEETING	20/1	26
27	20/1	EXT'G RECEPTACLES KITCHEN 1010	---	---	EXT'G RECEPTACLES KITCHEN 1004	20/1	28
29	20/1	EXT'G RECEPTACLES KITCHEN 1010	---	---	EXT'G RECEPTACLES STOR. 1011	20/1	30
31	20/1	EXT'G RECEPTACLES FUTURE 1012	---	---	EXT'G RECEPTACLES FUTURE 1043	20/1	32
33	20/1	EXT'G RECEPTACLES ROOM	---	---	EXT'G RECEPTACLES MECH 1020	20/1	34
35	20/1	EXT'G DRYER BATH 1042	---	---	EXT'G HAND DRYER BATH 1042	20/1	36
37	20/1	EXT'G DRYER BATH 1041	---	---	EXT'G HAND DRYER BATH 1041	20/1	38
39	20/1	SPARE TO BATH 1035	---	---	EXT'G FIRE ALARM COMPRESSOR	20/1	40
41	20/1	RECEPTACLE BELOW	---	---	EXT'G TUNNEL RECEPTACLES	20/1	42
43	20/1	SITE LIGHT PHOTOEYE	---	4007	---	---	44
45	20/1	SITE LIGHT PHOTOEYE	---	4007	PANEL 'A'	100/3	46
47	200/2	PANEL NPLLB	---	4007	---	---	48
49	---	SPACE	---	---	SPACE	---	50
51	---	SPACE	---	---	SPACE	---	52
53	---	SPACE	---	---	SPACE	---	54
55	---	SPACE	---	---	SPACE	---	56
57	---	SPACE	---	---	SPACE	---	58
59	---	SPACE	---	---	SPACE	---	60
61	---	SPACE	---	---	SPACE	---	62
63	---	SPACE	---	---	SPACE	---	64
65	---	SPACE	---	---	SPACE	---	66
67	---	SPACE	---	---	SPACE	---	68
69	---	SPACE	---	---	SPACE	---	70
71	---	SPACE	---	---	SPACE	---	72

LIGHTING FIXTURE SCHEDULE

TYPE	BRAND	MODEL #	MOUNTING TYPE	LAMP	TOTAL FIXTURE POWER	VOLTAGE	NOTES:
A	METALUX	24C2-LD5-35-UNV-L835-CD1-U-WAA	RECESSED	4458LM/3500K/LED	35.3W	UNV	WAVELINK WIRELESS SENSOR
XA	SURELITES	APC7R	EXIT SIGN	(1) LED	1.4W	120V	WITHOUT LED HEADS

ELECTRICAL SYMBOL LEGEND

SYMBOL	DESCRIPTION	NOTES
	SINGLE POLE STYLE SWITCH	MOUNT @ 44" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED
	2'x2' FIXTURE, TYPE X	SEE LIGHTING FIXTURE SCHEDULE FOR TYPES
	EMERGENCY LIGHTING FIXTURE	SEE LIGHTING FIXTURE SCHEDULE FOR TYPES
	EXIT SIGN, TYPE X	SEE LIGHTING FIXTURE SCHEDULE FOR TYPES
	GREENGATE ONW-P-1001-MV-X	WALLBOX MOUNTED PASSIVE INFRARED OCCUPANCY SENSOR
	DUPLEX OUTLET - 20 AMP	MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED
	DUPLEX OUTLET - GROUND FAULT	MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED
	DUPLEX OUTLET - WEATHER PROOF COVER	MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED
	QUADPLEX OUTLET - 20 AMP	MOUNT @ 24" A.F.F. TO BOTTOM OF BOX, UNLESS OTHERWISE NOTED
	JUNCTION BOX TO POWER POLES	PROVIDE JUNCTION BOX TO CONNECT TO POWER POLES TO FEED EACH CUBICLE AREA. VERIFY EXACT PLACEMENT OF POWER POLES IN FIELD BEFORE INSTALL.
	SPECIAL PURPOSE OUTLET, AS NOTED	REFER TO SHOP DRAWINGS FOR CONNECTION REQUIREMENTS
	MOTOR, AS SPECIFIED	REFERENCE SPECIFICATIONS FOR REQUIREMENTS
	FUSED DISCONNECT	REFER TO GENERAL ELECTRICAL NOTES AND ONE-LINE DIAGRAM. (VFD IS BEING SUPPLIED WITH UNIT FOR ROOTOPTS OR BY CONT. CONTRACTOR)
	LIGHTING/BRANCH CIRCUIT PANELS	REFER TO GENERAL ELECTRICAL NOTES AND ONE-LINE DIAGRAM.
	WIRELESS ACCESS POINT - BY OWNER	PROVIDE POWER TO WIRELESS ACCESS POINT, VERIFY LOCATION W/ OWNER.
	MECHANICAL THERMOSTAT	PROVIDE CONDUIT AND BACKBOX

WIRE SIZE REQUIREMENTS

NOTE:
BASED ON A MAXIMUM OF 6-VOLT DROP (5% ON 120V CIRCUITS). WIRES FOR RUNS OVER 100'-0" SHALL BE DETERMINED ON THIS A MAXIMUM OF A 5% DROP ALLOWED.

BRANCH CIRCUIT AMPS	LENGTH OF RUN - FROM PANEL TO FIRST CONNECTION - FEET									
	50'	60'	70'	80'	90'	100'	110'	120'	130'	
15	#12	#12	#12	#12	#12	#12	#10	#10	#10	
20	#12	#12	#12	#12	#10	#10	#10	#10	#8	
30	#10	#10	#10	#10	#8	#8	#8	#8	#6	

INVERTER SCHEDULE

TYPE	BRAND	MODEL	MOUNTING TYPE	POWER	INPUT VOLTAGE	OUTPUT VOLTAGE
INV-1	MYERS	LV-2-R1	WALL	154 VA	120 V	120 V

EATON WAVELINK BILL OF MATERIALS

WB1 - EATON W2L-RL-* WALL BOX CONTROLLER (VERIFY COLOR WITH OWNER)

WB2 - EATON W1L-* WALL BOX CONTROLLER (VERIFY COLOR WITH OWNER)

WAC - EATON WAC2-POE WIRELESS AREA CONTROLLER.

--- WIRELESS CONNECTION --- ALL LIGHTING CONNECTIONS ARE SHOWN FOR WIRELESS GROUPING ONLY.

--- SUPPLIER TO PROVIDE INITIAL PROGRAMING AND TRAINING FOR WAVELINK SYSTEM. (CONTACT CRITES TIDEY (231) 941-8686)

- ELECTRICAL NOTES**
- PRIOR TO SUBMITTING A PROPOSAL, BIDDER SHALL HAVE VISITED THE CONSTRUCTION SITE. HE SHALL BE FAMILIAR WITH THE EXISTING CONDITIONS UNDER WHICH HE WILL HAVE TO OPERATE AND WHICH WILL IN ANY WAY AFFECT THE WORK UNDER THIS CONTRACT. NO SUBSEQUENT ALLOWANCE WILL BE MADE IN THIS CONNECTION ON BEHALF OF THE CONTRACTOR FOR ANY ERROR OR NEGLIGENCE ON HIS PART.
 - ELECTRICAL WORK SHALL COMPLY WITH THE LATEST ENFORCEABLE EDITION OF THE N.E.C., LOCAL AND STATE CODES, ORDINANCES, REGULATIONS, INCLUDING THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA), AND ADA GUIDELINES WITH THE LOCAL CODE AUTHORITIES HAVING JURISDICTION.
 - ELECTRICAL CONTRACTOR SHALL OBTAIN ALL PERMITS, PAY ALL FEES, INCLUDING COSTS ASSESSED BY THE ELECTRIC UTILITY COMPANIES, AND ARRANGE FOR ALL INSPECTIONS FOR HIS WORK. AT THE COMPLETION OF ELECTRICAL WORK, THE ELECTRICAL CONTRACTOR SHALL FURNISH THE OWNER WITH ALL CERTIFICATES OF FINAL INSPECTION AND APPROVALS.
 - ELECTRICAL MATERIALS SHALL BE NEW, AND BEAR THE "UL" LABEL.
 - FUSES SHALL BE "UL" LISTED, DUAL AS MANUFACTURED BY BUSSMANN CO., OR APPROVED EQUAL (200,000 ERIC).
 - PLATES FOR SWITCHES AND RECEPTACLES SHALL BE IVORY.
 - FLOURESCENT FIXTURE BALLAST VOLTAGE RATING SHALL BE AS NOTED, NON, HIGH POWER FACTOR, ENERGY SAVING, CLASS P, "A" SOUND RATED. HIGH DISCHARGE (HID) BALLAST SHALL BE NON, HIGH POWER FACTOR, CONSTANT WATTAGE AUTO TRANSFORMER TYPE, WITH STARTING CURRENT NOT EXCEEDING THE OPERATING CURRENT.
 - PANEL BOARDS SHALL BE RATED 120/240V, 1 PHASE, 3W, OR AS NOTED WITH PLUG TYPE BRANCH CIRCUIT BREAKERS RATED TO A MINIMUM 10,000 A.I.C. PANEL BOARDS SHALL BE SIMILAR TO SQUARE D OR SIEMENS.
 - ELECTRICAL CONTRACTOR SHALL VERIFY EXACT ELECTRIC UTILITY COMPANIES SERVICE POINTS AND PRIMARY SERVICE CONDUIT, ROUTING, AND SIZE WITH UTILITY COMPANY SERVICE PLANNERS PRIOR TO BEGINNING WORK.
 - BRANCH CIRCUIT WIRE FOR LIGHTING, RECEPTACLE AND SMALL POWER SHALL BE COPPER, RATED 75 DEGREES C, MINIMUM SIZE #12 AWG, AND BE TYPE "THHN" AND BE INSTALLED IN EMT, UNLESS OTHERWISE NOTED OR REQUIRED BY CODE. FEEDERS AND SECONDARY SERVICE CONDUCTORS SHALL BE STRANDED COPPER WITH 600 VOLT INSULATION, RATED 90 DEGREES C, TYPE "THHN", AND BE INSTALLED IN EMT OR PVC CONDUIT, MINIMUM SIZE 1/2" UNLESS OTHERWISE NOTED OR REQUIRED BY CODE. ALL WIRE AND CABLE SHALL BE NEW AND SHALL BE DELIVERED TO PROJECT IN UNBROKEN AND UNDAMAGED CARTONS AND REELS.
 - ELECTRICAL CONTRACTOR SHALL GUARANTEE ALL WORK INSTALLED UNDER HIS CONTRACT TO BE FREE FROM DEFECTIVE WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE YEAR AFTER THE ACCEPTANCE OF THE BUILDING BY THE OWNER. SHOULD DEFECTS OCCUR WITHIN THIS PERIOD, REPAIR AND/OR REPLACE DEFECTIVE ITEMS AT NO EXPENSE.
 - ELECTRICAL CONTRACTOR SHALL COORDINATE LOCATIONS OF HIS EQUIPMENT AND WORK WITH OTHER BUILDING TRADES TO AVOID ANY INTERFERENCES BETWEEN HIS WORK AND THE WORK OF OTHER BUILDING TRADES. IF ANY DISCREPANCIES OCCUR, CONSULT WITH THE ARCHITECT AND/OR OWNER BEFORE CONTINUING.
 - LAMPS - ALL LAMPS SHALL BE CLASSIFIED "ENERGY SAVING", AND BE PROVIDED BY E.C.
 - THE CONTRACTOR SHALL BE HELD FULLY RESPONSIBLE FOR THE PROPER RESTORATION OF ALL EXISTING SURFACES REQUIRING PATCHING, PLASTERING, PAINTING AND/OR OTHER REPAIR DUE TO THE INSTALLATION OF ELECTRICAL WORK UNDER THE TERMS OF THIS SPECIFICATION. CLOSE ALL OPENINGS, REPAIR ALL SURFACES, ETC. AS REQ'D.
 - THE ELECTRICAL CONTRACTOR SHALL PERIODICALLY REMOVE FROM THE SITE ALL DEBRIS AND RUBBISH ACCUMULATING AS A RESULT OF THE ELECTRICAL INSTALLATION. UPON COMPLETION OF THE PROJECT, HE SHALL DISPOSE OF ALL DEBRIS AND RUBBISH AND SHALL LEAVE ALL AREAS CLEAN. THE INTERIORS OF ALL CABINETS, PULL BOXES, AND EQUIPMENT ENCLOSURES SHALL BE FREE OF ANY DEBRIS.
 - UNDERGROUND CONDUIT TO BE SCHEDULE 40 PVC.
 - ELECTRICAL JOINTS WILL BE PERMITTED ONLY IN JUNCTION AND OUTLET BOXES. ALL JOINTS SHALL BE FIRMLY BONDED TOGETHER AND TAPED OR SHALL BE MADE WITH MECHANICAL CONNECTORS.
 - ALL LOCATIONS OF DEVICES TO BE COORDINATED WITH ARCHITECT BEFORE ROUGH-IN.
 - FIELD VERIFY ALL CONNECTIONS TO EXT'G ELECTRICAL PANELS AND REVISE AS REQ'D TO PROVIDE PROPER POWER AND CIRCUITING.
 - FIELD VERIFY ALL EQUIPMENT NAMEPLATE DATA BEFORE CONNECTING EQUIPMENT.

LEELANAU COUNTY BUILDING HEALTH DEPT.
8537 E. GOVERNMENT CENTER DR.
SUTTONS BAY, MI 49682

SCHED./ NOTES - ELECTRICAL

Project number	#220804
Date	6/7/2023
Drawn by	AE
Checked by	JR

Leelanau County Government Center Lower Level Environmental Health Department Space

Leelanau County Government Center
8527 E. Government Center Drive Suttons Bay, Michigan 49682

June 23, 2023

Project Team

Architect:

FAH Architecture, PLLC
891 W. Conway Rd., Unit #16
Harbor Springs, Michigan 49740
PH: (231) 881-8624

Mechanical / Electrical/Plumbing Engineering Consultants:

Engineer: Apollo Engineering
13310 SW Bayshore Dr., Ste. C
Traverse City, Michigan 49684
PH: (231) 932-0800



6/23/2023

PROJECT MANUAL CONTENTS

DIVISION 0 BIDDING REQUIREMENTS

00030	Advertisement for Bids
00100	Instructions to Bidders
00200	Information Available to Bidders
00300	Bid Form - General Contractor
00400	Supplements to Bid Form
00500	Agreement
00700	General Conditions
00800	Supplementary Conditions

DIVISION 1 GENERAL REQUIREMENTS

01010	Summary of Work
01019	Contract Considerations
01028	Change Order Procedures
01040	Coordination
01045	Cutting and Patching
01050	Field Engineering
01060	Regulatory Requirements
01090	References
01200	Project Meetings
01300	Submittals
01310	Progress Schedules
01400	Quality Control
01500	Construction Facilities and Temporary Controls
01600	Material and Equipment
01650	Facility Startup/Commissioning
01700	Contract Closeout
01710	Cleaning
01720	Project Record Documents
01740	Warranties

DIVISION 2 SITE WORK

02070	Selective Demolition
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DIVISION 3 CONCRETE

03001	Concrete General Requirements
03300	Cast in Place Concrete

DIVISION 4 MASONRY

Not Used

DIVISION 5 METALS

Not Used

DIVISION 6 WOOD AND PLASTICS

06100	Rough Carpentry
06400	Architectural Woodwork

DIVISION 7 THERMAL AND MOISTURE PROTECTION

Not Used

DIVISION 8 DOORS AND WINDOWS

08100 Metal Doors and Metal Frames
08200 Wood Doors
08700 Door Hardware
08800 Glass and Glazing

DIVISION 9 FINISHES

09250 Gypsum Board Systems
09300 Tile
09500 Acoustical Treatment
09680 Carpet
09900 Painting

DIVISION 10 SPECIALTIES

10520 Fire Extinguishers and Cabinets

DIVISION 11 EQUIPMENT

Not Used

DIVISION 12 FURNISHINGS

Not Used

DIVISION 13 SPECIAL CONSTRUCTION

Not Used

DIVISION 21 WET/DRY PIPE FIRE SUPPRESSION SYSTEM

21 13 00 Wet/Dry Pipe Fire Suppression System

DIVISION 22 PLUMBING SYSTEMS

22 11 16 Plumbing Piping

22 30 00 Plumbing Equipment

22 40 10 Plumbing Specialties

DIVISION 23 HVAC SYSTEMS

23 00 00 Mechanical General Provisions

23 05 00 Basic Mechanical Materials and Methods

23 05 29 Supports and Anchors

23 05 48 Vibration Isolation

23 05 53 Mechanical Identification

23 05 93 Testing Adjusting and Balancing

23 05 94 IAQ for Occupied Buildings Under Construction

23 07 00 Thermal Insulation

23 21 13 Hydronic Piping

23 31 00 Ducting

23 41 00 Air Filters

DIVISION 25 INTEGRATED AUTOMATION

25 00 00 Direct Digital Control System

25 51 00 Sequence of Operation

DIVISION 26 ELECTRICAL

26 00 00 Electrical General Provisions

26 01 26 Testing

26 05 00 Basic Electrical Materials and Methods

26 05 26 Grounding

26 06 20 Panelboards

26 10 00 Service and Distribution

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

28 31 00 Integrated Life Safety System

DOCUMENT 00030
ADVERTISEMENT FOR BIDS

Owner: Leelanau County
8527 E. Government Center Drive
Suttons Bay, MI. 49682

Architect: FAH Architecture, PLLC
891 W. Conway Road, Unit #16
Harbor Springs, MI 49740
Telephone: (231) 881-8624

Issue Date: June 23, 2023

General Contractors are invited to submit a bid under seal to Leelanau County. Bids shall be delivered to:

Laurel Evans, Executive Assistant
Leelanau County Administration
8527 E. Government Center Drive - Suite #101
Suttons Bay, MI. 49682

before 3:00 p.m. local time on Monday, July 31, 2023 for a public bid opening.

The work is described as follows:

The project is the interior build out of approximately 2,711 square feet in the lower level of the Leelanau County Government Center to be used by the Leelanau Health. Furnish all materials, labor and incidental services required to complete and leave ready for operation the interior work.

The project location is the Leelanau County Government Center, 8527 E. Government Center Drive, Suttons Bay, Michigan 49682.

A pre-bid meeting is scheduled for Wednesday, July 19, 2023, at 10:00 a.m. and shall be held at the County Board Room located on the first floor of the Leelanau County Government Center. Attendance is recommended.

Bid Documents may be obtained by contacting Traverse City Reproduction and Supply, 1373 Barlow St., Traverse City 49686. Phone (231) 947-6284 or website: www.traverserepro.com. Bid documents can be reviewed at selected plan rooms located in Michigan and at the Leelanau County Administrator's Office.

Bid security shall accompany bid in the form of a bid bond, certified check, or cashier's check for no less than five (5%) percent of the Bid Price.

Refer to Instructions to Bidders in the Project Manual for full bidding requirements.

Your offer will be required to be submitted under a condition of irrevocability for a period of 90 days after submission.

Leelanau County reserves the right to reject any and all bids and choose the bid that is in the best interest of the County. Any party who bid under this policy does so of their own free will and without liability to the County. A bid may be awarded to a higher bidder for reasons such as but not limited to, quality, service, reliability, convenience, dependability, etc. By submitting a bid, the bidder is acknowledging that there will be no contractual relationship between the County and the bidder until both parties have formally approved and signed a written contract to be developed by County's legal counsel.

END OF DOCUMENT

DOCUMENT 00100
INSTRUCTIONS TO BIDDERS

1.01 DEFINITIONS

- A. Bid Documents include the Bidding Requirements and the Contract Documents. The Bidding Requirements consist of the Advertisement for Bids, Instructions to Bidders, Information Available to Bidders, the Bid Form, and Supplements to Bid Form. The Contract Documents consist of the Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and all Addenda issued prior to execution of the Contract. The Bidding Requirements are intended to form part of the Contract Documents and shall be enumerated in the Agreement between the Owner and Contractor.
- B. Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bid Documents.
- C. Addenda are written or graphic instruments issued by the Architect/Engineer prior to the execution of the Contract which modify or interpret the Bid Documents by additions, deletions, clarifications, or corrections.
- D. A Bid is a complete, properly signed, and sealed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bid Documents.
- E. The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bid Documents as the base, to which work may be added or from which work may be deleted for sums stated in Alternate Bids.
- F. An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bid Documents, is accepted.
- G. A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, services, or a portion of the work as described in the Bid Documents.
- H. A Bidder is a person or entity who submits a Bid.
- I. A Sub-bidder is a person or entity who submits a bid to a Bidder for materials or labor for a portion of the Work.

1.02 BIDDER'S REPRESENTATION

- A. The Bidder by making a Bid represents that:
 - 1. The Bidder has read and understands the Bid Documents and the Bid is made in accordance therewith.
 - 2. The Bidder has read and understands the Bid Documents and Contract Documents, to the extent that such documentation related to the Work for which the Bid is submitted, for other portions of the Project, if any, being bid concurrently or presently under construction.
 - 3. The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the Contract Documents.

4. The Bid is based upon the materials, equipment, and systems required in the Bid Documents without exception.

1.03 AVAILABILITY OF DOCUMENTS

- A. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes.
- B. Bid Documents are interrelated and cross-referenced; bids must be made on a complete review of all information. No partial sets will be available.
- C. Bid Documents may not be obtained by bidders from the owner.
- D. Bid Documents can be obtained by general contract and subcontract Bidders as described in the Advertisement for Bids.
- E. Bid Documents are on display at the office of the Architect/Engineer and the following plan rooms:

Builders Exchange of Michigan:

Traverse City Reproduction and Supply
1373 Barlow St., Traverse City 49686.
Phone (231) 947-6284
www.traverserepro.com.

- F. Copies of the Agreement and General Conditions of the Contract are available for review at the office of the Architect/Engineer. Copies can also be purchased by contacting the Michigan American Institute of Architects (AIA).

1.04 EXAMINATION OF DOCUMENTS, SITE AND LOCAL CONDITIONS

- A. Before submitting bids, bidders shall carefully examine all Drawings, read the entire Project Manual, and all Contract Documents, including all Addenda. Bidders shall visit the site in order to inform themselves of all conditions, which can affect the work or the cost thereof. Failure or omission of bidder to receive or examine any form, instrument, Addendum or other document, or to visit the site and acquaint himself with existing conditions shall in no way relieve any bidder from obligation with respect to his bid.
- B. Upon receipt of Bid Documents verify that documents are complete. Notify Architect/Engineer should the documents be incomplete.
- C. Immediately notify the Architect/Engineer upon finding discrepancies or omissions in the Bid Documents.
- D. The project location is the Leelanau County Government Center which can be examined during the prebid meeting. Additional site visits can be arranged by contacting Maintenance Director Jerry Culman at (231) 256-8160.

1.05 INTERPRETATION DURING BIDDING

- A. Direct all questions in writing to FAH Architecture, PLLC by email at f_hackl@yahoo.com or by mail to 891 W. Conway Rd., Unit #16, Harbor Springs, MI 49740. Include with all questions, name of project, return name, and contact information. Use the Request for Information form contained in Section 01040 - Coordination of the Project Manual.
- B. Addenda may be issued during the Bidding period, a copy of which will be forwarded to each known General Contract Bidder and each Plan Room. General Contract Bidders shall verify that each subcontract bidder is informed of all Addenda at the time sub-bid information is received. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Sum.
- C. If any bidder is in doubt as to the true meaning, spirit, and intent of the Drawings, Project Manual or any part of the Contract Documents, bidder may request an interpretation. Any interpretation of Contract Documents, if made, will be by addendum only. The Owner and the Architect/Engineer are not responsible for any other explanations or interpretations made prior to closing time for receipt of bids. No explanations or interpretations made orally will be considered binding.
- D. Clarification requests from Bidders must be made in writing not less than 7 calendar days before date set for receipt of Bids. The reply will be in the form of an Addendum.
- E. Figures given on the Drawings govern scale measurements. Discrepancies shall be brought to the attention of the Architect/Engineer for interpretation and the Architect/Engineer's decision, in writing, shall govern.
- F. If the Drawings and Project Manual disagree in themselves or with each other, estimate on and furnish the greater quantity or better quality unless otherwise instructed in writing by the Architect/Engineer.
- G. Color selections for any product will be selected (by the Architect) from a full range of all standard and premium colors and price groups and shall not be limited in the number of different colors selected, unless specifically indicated otherwise in the specification sections for each product. The Contractor is required to submit a full range of product samples for the Architect's selection.

H. 1.06 PRODUCT/SYSTEM SUBSTITUTIONS

- A. Refer to Section 01600.
- B. The Architect/Engineer will consider substitutions up to 10 days before receipt of Bids.
- C. Bidders shall include in their Bid any change in the Work, in the Contract Time and in the Contract Sum required to use substitute materials, products, and equipment. A later claim by the Bidder for an addition to the Contract Time or Contract Sum because of changes in Work necessitated by use of substitute materials, products, and equipment shall not be considered.
- D. The Architect/Engineer will issue an Addendum for accepted substitute materials, products, and equipment to the plan rooms, known general contract bidders, and known subcontractors and suppliers including those requesting substitutions.

1.07 BASIS OF BID

- A. The intent of this Bid request is to obtain a stipulated sum offer to perform Work to complete construction for the Project of these documents.

1.08 PREPARATION OF BIDS

- A. Bids shall be submitted on forms identical to the form included with the Bid Documents.
- B. Fill out Bid Form completely, type or print date of submission, organization's name and mailing address.
- C. Where so indicated by the makeup of the Bid Form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the amount written in words shall govern.
- D. Indicate in United States currency dollar amounts the stipulated sum.
- E. Indicate in United States currency dollar amounts the alternate amounts. For Alternate bid amounts to add to the base Bid, blacken out the word deduct so that only ADD remains readable. For alternate bid amounts to deduct from the base bid, blacken out the word add so that only the word DEDUCT remains readable. Refer to Section 01019 - Contact Considerations for description of Alternate items.
- F. Indicate in United States currency dollar amounts the unit pricing amounts. Unit prices are to assist in determining cost of changes to Work and for future Work. Unit pricing shall not be considered a portion of the Work indicated in the Contract Documents and shall not affect the stipulated sum Bid. Indicate in the unit column the price for a single unit, and in the total price column indicate the total cost based on the estimated quantity. Refer to Section 01026 - Unit Prices and Drawings for additional information on unit price items.
- G. Indicate the number of calendar days required from notice to proceed until date of substantial completion. This should be carefully estimated according to present-day deliveries and conditions, in order that no extension of time will be necessary. The construction period is subject to review and approval by the Owner.
- H. Indicate the percent for overhead and profit combined which will be added to material and labor cost and included in the total cost to the Owner for changes in the Work. Refer to Document 00800 - Supplementary Conditions for limits on the percent of combined overhead and profit for changes in the Work.

- I. Record Addenda numerically and indicate the date for each.
 - J. The Bid Form shall be signed and sealed by the Bidder, as follows:
 - 1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature.
 - 2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature.
 - 3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. If the Bid is signed by officials other than the President and Secretary of the company, or the President/Secretary/Treasurer of the company, a copy of the by-law resolution of the Board of Directors authorizing them to do so, must also be submitted with the Bid Form in the Bid envelope.
 - 4. Joint Venture: Each party of the joint venture shall execute the Bid Form in a manner appropriate to such party as described above, similar to the requirements of a Partnership.
 - K. The signer of the Bid must initial alterations and erasures.
 - L. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.
 - M. Fill out, sign and seal the Supplements to Bid Form.
 - N. Submit two (2) copies of the executed offer on the Bid Form provided and the Supplement to Bid Form.
 - O. Include bid security deposit and agreement to provide construction performance and payment bond in the envelope with the bid forms and supplements.
 - P. By submitting a bid, the bidder is acknowledging that there will be no contractual relationship between the Owner and bidder until both parties have formally approved and signed the AIA Document A101, AIA Document A201, and Document 00800 Supplementary Conditions.
- 1.09 REQUIREMENTS FOR BID SECURITY
- A. Bids shall be accompanied by a security deposit in the form of a Bid Bond, certified check, or cashier's check in the amount of a sum no less than 5 percent of the Bid Sum for a duration of 90 days.
 - B. The Bidder shall endorse the Bid Bond in the name of the Owner as obligee, signed and sealed by the Bidder as principal and the Surety.
 - C. The Surety Company writing the Bid Bond must be listed in the Federal Register as published by the U.S. Department of Treasury, in the most recently revised Circular 570. In addition, the Surety Company must be licensed and admitted to do business in the State of Michigan. The Bidder shall provide the Owner with evidence that the Surety Company is listed in the current U.S. Department of Treasury Circular 570 and is licensed and admitted to do business in the State of Michigan.
 - D. After a Bid has been accepted, securities will be returned to all respective unsuccessful Bidders.

- E. The security deposit of successful bidder will be returned after signing of the Owner-Contractor Agreement. If bidder is unable to execute the Agreement, the bidder's security shall be forfeited.
- F. If no contract is awarded, all security deposits will be returned within ten days after the expiration of offer duration period of 90 days.

1.10 REQUIREMENTS FOR CONSTRUCTION PERFORMANCE BOND AND CONSTRUCTION PAYMENT BOND

- A. Submit with the Bid an Agreement that if awarded the contract, Bidder will provide in addition to the required Bid Bond a Construction Performance Bond and Construction Payment Bond, which meet the following requirements.
- B. The accepted Bidder shall provide a Construction Performance Bond by a surety company satisfactory to the Owner, in an amount equal to one hundred percent (100%) of the total sum of the contract as security for faithful performance of the contract.
- C. The accepted Bidder shall provide a Construction Payment Bond by a surety company satisfactory to the Owner, in an amount equal to one hundred percent (100%) of the total sum of the contract as security for the payment of all persons performing labor and/or furnishing materials.
- D. The Bidder shall endorse the Construction Performance Bond and Construction Payment Bond in the name of the Owner as obligee, signed and sealed by the Bidder as principal and the Surety.
- E. The Surety Company writing the Performance and Payment Bonds must be listed in the Federal Register as published by the U.S. Department of Treasury, in the most recently revised Circular 570. In addition, the Surety Company must be licensed and admitted to do business in the State of Michigan. The Bidder shall provide the Owner with evidence that the Surety Company is listed in the current U.S. Department of Treasury Circular 570 and is licensed and admitted to do business in the State of Michigan.
- F. Construction Performance Bond and Construction Payment Bond shall be held until time of substantial completion, receipt by the Owner of all required certifications and occupancy approvals from authorities having jurisdiction over the work, and acceptance of the Project by the Owner.

1.11 ADDITIONAL CONTRACTOR INFORMATION

- A. The low Bidders may be requested to complete, within 48 hours after receipt of the written request, the Supplemental Forms and Appendices identified below:

Appendix A - Bid Breakdown.

Appendix B - Qualification Statement: Include the names, description and contract amounts for similar projects. Provide the name and telephone number of the Owner/ Client contact persons.

Appendix C-Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.

- B. The selected Bidders shall submit a detailed cost or pricing breakdown by trades and/or suppliers within 10 calendar days of receipt of notice of acceptance and prior to execution of agreement.

1.12 IDENTIFICATION AND SUBMISSION OF BIDS

- A. Submit two (2) copies of the executed offer on the Bid Forms provided, signed with the required security in a closed opaque envelope, clearly identified on the outside of the envelope:

Project name: Leelanau County Center Lower Level, Environmental Health Department Space
Owner's name: Leelanau County
Bidder's name:

- B. Bidders shall be solely responsible for the delivery of their Bids in the manner and time prescribed.
- C. Bids signed, executed, and dated will be received by:

Laurel Evans, Executive Assistant
Leelanau County Administration
8527 E. Government Center Drive - Suite 101
Suttons Bay, MI. 49682

before: 3:00 p.m., local time on Monday, July 31, 2023

- D. Offers submitted after the above time will be returned to the Bidder unopened.

1.13 MODIFICATION OR WITHDRAWAL OF BIDS

- A. Bid changes or withdrawal shall be permitted until the time of the bid opening without penalty.
- B. Amendments to the submitted offer will be permitted and will require a written request for modification or withdrawal endorsed by the same party or parties who signed the offer. One copy of request shall be submitted to each the Owner and to the Architect/Engineer.

1.14 DISQUALIFICATION OF BIDDERS

Bids that are unsigned, improperly signed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, will at the discretion of the Owner, be declared unacceptable.

- A. Bid Forms, Appendices, and enclosures which are improperly prepared will at the discretion of the Owner, be declared unacceptable.
- B. Failure to provide security deposit, bonding or insurance requirements will at the discretion of the Owner invalidate the Bid.
- C. Improperly completed information, irregularities in bid bond, and/or failure to provide agreement to bond may be cause the Bid invalid.

1.15 PRE-BID CONFERENCE

- A. A Bidders conference is scheduled for 10:00 a.m. local time on Wednesday, July 19, 2023 and shall be held at the Leelanau County Board of Commissioners Room located at the first floor of the Leelanau County Government Center.
- B. All general contract and major subcontract Bidders and Suppliers are invited. Attendance is advised but not mandatory for general contractors interested in bidding.
- C. Representatives of the Owner will be in attendance.
- D. Information relevant to the Bid Documents will be recorded in an Addendum, issued to Bid Document recipients.
- E. Copies of the sign-in sheet for the pre-bid conference will be made available, if requested from the owner.

1.16 OPENING OF BIDS

- A. Bids are to be delivered to Leelanau County, Attn. Lauren Evans, Executive Assistant, Leelanau County Administration, Suite 101 located at 8527 E. Government Center Drive, Suttons Bay, MI. 49682, Monday, July 31, 2023 before 3:00.
- B. A public bid opening will occur shortly after close of bidding.

1.17 EVALUATION AND CONSIDERATION OF BIDS

- A. Owner reserves time to tabulate, review, and evaluate the bids.
- B. The County reserves the right to reject any and all bids and choose the bid that is in the best interest of the County. Any party who bid under this policy does so at their own free will and without liability to the County. A bid may be awarded to a higher bidder for reasons such as but not limited to: quality, service, reliability, convenience, dependability, etc.
- C. By submitting a bid, the bidder is acknowledging that there will be no contractual relationship between the County and the bidder until both parties have formally approved and signed a written contract to be developed by County's legal counsel.
- D. Considerations or factors that are important to the Project are as follows:
 - 1. Amount of the bid, however, low bid alone will not necessitate award.
 - 2. Contract time.
 - 3. Percent of overhead and fee combined for changes in the work by change orders.
 - 4. Experience and qualifications in completing projects of similar type, size, and scope.
 - 5. References.
- E. After acceptance by the Owner, the Owner will issue to the successful Bidder, a written Bid Acceptance or Notice to Proceed. The successful Bidder shall commence work within ten calendar days after Notice to Proceed is issued.

1.18 EXECUTION OF CONTRACT

- A. The Owner reserves the right to make changes to AIA Document A101 - Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum (2017 Edition), AIA Document A201 - General Conditions of the Contract for Construction (2017 Edition), and Document 00800 Supplementary Conditions up until the time they are presented for execution by the parties.
- B. Contractors shall commence work within ten calendar days after the Owner shall have given his written notice to commence construction and shall diligently prosecute such construction.

END OF DOCUMENT

DOCUMENT 00200
INFORMATION AVAILABLE TO BIDDERS

1.01 SUMMARY

- A. Documents contained within this Section are information made available to the Architect/Engineer for purposes of design. The Documents were prepared by others. The Architect/Engineer does not warrant the accuracy or completeness of the Documents.
- B. Additional Documents listed in this Section are indicated for the Contractor's consideration and the information may be requested by the General Contractor.

1.02 INFORMATION FROM THE ARCHITECT

- A. Existing Drawings:
 - 1. No representation as to the accuracy of the existing drawings is offered. Bidders are to use their own judgment and field inspection.
 - 2. Drawings will be made available upon request.

END OF DOCUMENT

DOCUMENT 00 00
BID FORM - GENERAL CONTRACTOR

To: Leelanau County
8527 E. Government Center Drive
Suttons Bay, MI. 49682

Project: Leelanau County Center Lower Level, Environmental Health Department Space

Date: _____

Submitted by: _____
(full name)

(full address)

1. OFFER

Having examined the place of the Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by FAH Architecture, PLLC, Architect/Engineer for the above-mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Stipulated Sum of:

_____ dollars

(\$ -----)

We have included herewith the required bid security deposit and agreement to provide construction performance and payment bond as required by the Instruction to Bidders. All applicable federal, state, and local taxes are included in this Bid Sum.

2. CONTRACT TIME

If this Bid is accepted, we will:

Complete the Work within -----calendar days of notice to proceed.

3. CHANGES IN THE WORK

The percent of ____ for overhead and fee combined will be added to material and labor cost for changes in the work by change orders.

4. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted therein have been considered and all costs thereto are included in the Bid Sum.

Addendum # _____ Dated _____

Addendum # _____ Dated _____

Addendum # _____ Dated _____

5. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for the period stated in the advertisement for bid from the bid closing date.

By submitting a bid, the bidder is acknowledging that there will be no contractual relationship between the Owner and bidder until both parties have formally approved and signed the AIA Document A101, AIA Document A201, and Document 00800 Supplementary Conditions.

If the Owner accepts this Bid within the time period stated above, we will:

1. Execute the Agreement within ten days of receipt of Notice of Award.
2. Furnish the required bonds within ten days of receipt of Notice of Award in the form described in the Instructions to Bidders.
3. Commence work within ten calendar days after written Notice to Proceed.

If this Bid is accepted within the time stated, and we fail to execute the agreement or we fail to provide the required Bonds, the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this Bid and the Bid upon which the Contract is signed.

In the event our Bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period.

6. APPENDICES

To be submitted upon request.

7. BID FORM SIGNATURE(\$)

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

(Authorized signing officer	Title)
-----------------------------	--------

(Authorized signing officer	Title)
-----------------------------	--------

(Witness)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT

**DOCUMENT 00400
SUPPLEMENTS TO BID FORM**

To: Leelanau County
8527 E. Government Center Drive
Suttons Bay, MI. 49682

Project: Leelanau County Center Lower Level, Environmental Health Department Space

Date: _____

Submitted by: _____
(full name)

(full address)

In accordance with Instructions to Bidders and Bid Form, we include the Supplements to Bid Form Appendices listed below. The information provided shall be considered an integral part of the Bid Form.

These Appendices are as follows:

Appendix A - Bid Breakdown: Include separate amounts as indicated that are included in the Base Bid.

Appendix B - Qualification Statement: Include the names, description and contract amounts for similar projects.

Appendix C-Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.

SUPPLEMENTS TO BID FORM SIGNATURE(S)

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

(Authorized signing officer Title)

(Authorized signing officer Title)

(Witness)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT
(also, see attached referenced above)

APPENDIX A - BID BREAKDOWN

(For Information Only)

The following Bid Breakdown referenced in the Bid submitted by:

(Bidder - please print the full name of your Proprietorship, Partnership, or Corporation)

(Authorized signing officer

Title)

Date: _____ and which is an integral part of the Bid Form.

The following amounts are included in the above base bid price:

General Trades and Interior Finishes \$ _____

Mechanical \$ _____

Electrical \$ _____

Total Bid Amount: \$ _____

**DOCUMENT 00500
AGREEMENT**

1. AGREEMENT

American Institute of Architects (AIA) Document A101, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum (2017 Edition), forms the basis of Contract between the Owner and Contractor. All provisions, which are not so amended or supplemented, remain in full force and effect.

2. SUPPLEMENTARY CONDITIONS

Refer to Document 00800 for amendments to this portion of the Agreement.

The Owner reserves the right to make changes to these documents up until the time they are presented for execution by the parties.

END OF AGREEMENT

**DOCUMENT 00700
GENERAL CONDITIONS**

1. GENERAL CONDITIONS

American Institute of Architects (AIA) Document A201, General Conditions of the Contract for Construction (2007 Edition), Articles 1 through 14 inclusive, is the General Conditions between the Owner and Contractor.

2. SUPPLEMENTARY CONDITIONS

Refer to Document 00800 for amendments to these General Conditions.

The Owner reserves the right to make changes to these documents up until the time they are presented for execution by the parties.

END OF GENERAL CONDITIONS

DOCUMENT 00800
SUPPLEMENTARY CONDITIONS

The following supplements modify, change, delete from, or add to the Master Agreement, AIA Document A101, and General Conditions for the Contract for Construction, AIA document A201. Where any article or any paragraph, subparagraph or clause thereof is not modified or deleted, unaltered provisions of that article, paragraph, subparagraph or clause remain in effect.

The terms used in the Supplementary Conditions, which are defined in the General Conditions of the Contract for Construction (AIA Document A201 - 2007 Edition), have the meanings assigned to them in the General Conditions.

AIA DOCUMENT A201 SUPPLEMENTS:

AMEND ARTICLE 1 AS FOLLOWS:

Add Subparagraphs to 1.1:

- 1.1.1.1 Division 1 - General Requirements governs the execution of all sections of the Specifications from Division 2 through Division 16.
- 1.1.9 MISCELLANEOUS DEFINITIONS
 - 1.1.9.1 The term "product" includes materials, systems and equipment.
 - 1.1.9.2 The term "Project Manual" includes the bidding requirements, Conditions of the Contract and the Specifications.

Revise Subparagraph 1.2.1:

Add to the end of first sentence: "and to make all working parts operational."

Add to the end of the paragraph: "Should conflicts, errors, or discrepancies remain unresolved within the final ten (10) days before bids are due, estimate on and furnish the greater quantity or better quality unless resolution is received in writing from the Architect/Engineer."

Add Subparagraph 1.2.4:

- 1.2.4 Should there be conflicts, errors, or discrepancies between or within the Contract Documents, that which requires the highest degree of performance (quality, quantity, strength, finish, completion, complexity, sophistication, etc.), will be required and shall be provided at no increase in the contract amount. All such conflicts shall be brought to the attention of the Architect/Engineer for their interpretation of the intent of the drawings and/or specifications.

AMEND ARTICLE 2 AS FOLLOWS:

Delete Subparagraph 2.1.2.

- 2.3 In addition, insert at the end of Article 2.3 the following:

"This right shall be in addition to, and not in restriction of, the Owner's rights under Article 12.2."

Revise Subparagraph 2.4.:

- 2.4 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-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 cost of correcting such deficiencies, including compensation for the Architect's additional services and expenses made necessary by such default, neglect or failure and legal fees. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

AMEND ARTICLE 3 AS FOLLOW:

Revise Subparagraph 3.3.2:

- 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, Subcontractors and their respective agents and employees, and other persons performing portions of the Work under a contract with the Contractor, a Subcontractor, or a Sub subcontractor.

- 3.3.4 Add the following provision as a new Article 3.3.4:

"If any of the Work is required to be inspected or approved by any public authority, the Contractor shall cause such inspection or approval to be performed. No inspection performed or failed to be performed by the Owner hereunder shall be a waiver of any of the Contractor's obligations hereunder or be construed as an approval or acceptance of the Work or any part thereof."

- 3.3.5 Add the following provision as a new Article 3.3.5:

"The Contractor acknowledges that it is the Contractor's responsibility to hire all personnel for the proper and diligent prosecution of the Work and the Contractor shall use its best efforts to maintain labor peace for the duration of the Project. In the event of a labor dispute, the Contractor shall not be entitled to any increase in the Contract Sum."

Add Subparagraph 3.4.4:

3.4.4 POLICIES OF EMPLOYMENT

3.4.4.1 The Contractor shall maintain policies of employment as follows:

3.4.4.2 The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, age, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, color, age, sex or national origin. 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, notices setting forth the policies of non-discrimination.

3.4.4.3 The Contractor and all Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, age, sex, or national origin.

3.4.4.4 The Contractor or his collective bargaining representative will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the said labor union or worker's representative of the Contractor's commitments under this section.

Revise Subparagraph 3.6:

Add to the end of the paragraph: "including, but not limited to, all Sales Taxes, Use Taxes, Occupational Taxes, Excise Taxes, Social Security Benefits, Unemployment Compensation Taxes, or similar levies on all materials, labor, tools, and equipment furnished under this Agreement, as required by the Statutes of the State in which the project is located.

"(a) The Contractor's fee includes, and the Contractor shall be solely responsible for paying, any and all taxes, excises, duties and assessments ("Taxes") arising out of the Contractor's performance of the Work in any manner levied, assessed or imposed by any government or agency having jurisdiction.

(b) The Contractor shall promptly pay and discharge when due, unless the validity or application to the Work is being contested in good faith, any and all Taxes, together with any interest and penalties, the responsibility and liability for which is assumed by the Contractor pursuant to the preceding paragraph. If any such Taxes are levied, assessed or imposed upon the Owner, the Owner shall notify the Contractor and the Contractor shall promptly pay and discharge the Taxes, but upon the written request and at the expense of the Contractor, the Owner shall assist the Contractor in contesting the validity or application of such Taxes. If the Owner receives a refund of all or any part of the Taxes (including a refund of interest or penalties), the amount refunded to the Owner shall promptly be remitted to the Contractor, less any expenses of the Owner associated with contesting the Taxes not previously reimbursed by the Contractor to the Owner."

3.7.1. Add the following language at the end of Article 3.7.1:

"The Contractor shall procure all certificates of inspection, use, occupancy, permits and licenses, pay all charges and fees and give all notices necessary and incidental to the Work. Certificates of inspection, use and occupancy shall be delivered to the Owner upon completion of the Work in sufficient time for occupation of the project in accordance with the approved schedule for the Work."

Revise Subparagraph 3.7.2:

Add to end of paragraph: "If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless the Owner and the Architect, and their respective employees, officers and agents, against any resulting fines, penalties, judgments or damages, including reasonable attorneys' fees, imposed on or incurred by the parties indemnified hereunder."

3.7.3. Delete Article 3.7.3 and substitute the following in lieu thereof:

"It shall be the obligation of the Contractor to review to the best of its ability the Contract Documents to determine and to notify the Owner and the Architect of any discrepancy between building codes and regulations of which the Contractor has knowledge. The Contractor shall not violate any zoning, setback or other local requirements of applicable laws, codes and ordinances, or of any recorded covenants of which the Contractor has knowledge. If the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, rules or regulations, the Contractor promptly shall notify the Owner and Architect in writing, and necessary changes shall be accomplished by appropriate Modification."

Add Subparagraphs to 3.7:

3.7.6 The General Contractor shall submit plans and Specifications to the Office of the Building Inspector and/or any other department having jurisdiction over work of this character and shall obtain and pay for examination fees, general building permits, and any other fees required by said departments. Unless otherwise specified, he shall also make all cash deposits required by State, County, or City authorities and pay for repairing of all walks, pavements, roadways, lawns, shrubs, trees, structures and utilities damaged by execution of his work.

The Electrical Contractor shall procure all necessary permits and certificates, pay for all fees, and arrange for all necessary inspections required by State, County, or City authorities for all electrical work, meters, lighting fixtures, and other electrical items and pay for repairing of all walks, pavements, roadways, lawns, shrubs, trees, structures and utilities damaged by execution of his work.

The Site Preparation, Plumbing, Heating, Air Conditioning, and Ventilating Contractors shall procure all necessary permits and certificates, pay all fees, and arrange for all necessary inspections required by State, County, or City authorities and pay for repairing of all walks, pavements, roadways, lawns, shrubs, trees, structures and utilities damaged by execution of their respective work.

Revise Subparagraph 3.9.1:

Revise first and second sentences to read: "The Contractor shall employ and maintain a competent superintendent and necessary assistants approved by the Architect/Engineer and Owner throughout the period of construction. The superintendent shall be deemed an Agent of the Contractor and any orders given him by the Architect/Engineer shall be binding upon the Contractor."

Add to the end of the paragraph: "The superintendent of the Contractor may not be removed from (or replaced on) the job during the period of construction without approval of the Architect/Engineer and Owner."

3.9.1. Add the following language at the end of Article 3.9.1:

'The superintendent shall be satisfactory to the Owner in all respects, and Owner shall have the right to require Contractor to dismiss from the Project any superintendent whose performance is not satisfactory to Owner, and to replace such superintendent with a superintendent satisfactory to Owner. The Contractor shall not replace the superintendent without the consent of the Owner except with another superintendent satisfactory to the Owner in all respects."

Add Subparagraph 3.9.4:

3.9.4 "As directed by the Architect/ Engineer, there is to be held at his field office a meeting of the representatives of the various trades engaged about the Work, for furthering the progress of the Work and given of clarifications by the Architect and Instructions by the Owner. Where the Contractor's Representatives fail in attendance or in executing the instructions given them, they shall on request of the Owner be dismissed from the Work and other representatives must be immediately substituted."

Add Subparagraph 3.9.5:

3.9.5 "A list of all supervisory personnel, including the project manager and superintendent, that the Contractor intends to use on the Project and a chain-of-command organizational chart shall be submitted to the Owner for approval. The Contractor shall not engage supervisory personnel or utilize an organization and chain-of-command other than as approved by Owner in writing and shall not change such personnel or form of organization without the written approval of the Owner."

3.10.1. Delete Article 3.10.1 and substitute in lieu thereof the following:

"The Project construction schedule shall not exceed time limits current under the Contract Documents, shall be updated and revised by the Contractor at appropriate intervals as required by the conditions of the Work and Project, shall be related to the Project scope as defined by the Contract Documents, shall provide for expeditious and practicable execution of the Work of this Contract and shall not be modified or extended without the prior approval of the Owner in each instance."

Revise Subparagraph 3.11:

In the first sentence, replace "and approved Shop Drawings, Product Data and Samples with the following: "and Contractor approved Shop Drawings, Product Data and Samples which have been reviewed by the Architect/Engineer."

3.11 Insert immediately after the word "Work as constructed" in the last sentence of Article 3.11 the following:

"Signed by the Contractor, certifying that they show complete "as-built" conditions, stating sizes, kind of materials, vital piping, conduit locations and similar matters."

Revise Subparagraphs to 3.12:

Add new sentence to the end of 3.12.5: Contractor shall indicate his review and approval by means of his stamp, with his initials and date of review, prior to submitting to the Architect/Engineer for review.

Revise 3.12.7 to read as follows:

"No portion of the work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been reviewed by the Architect/Engineer as provided in Subparagraph 4.2.7. All such portions of the Work shall be in accordance with submittal reviewed by the Architect/Engineer and bearing his review stamp."

Revise 3.12.8 to read as follows:

The Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's review of Shop Drawings, Product Data, Samples or similar submittal unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in the Shop Drawings, Product Data, Samples or similar submittal by the Architect's review thereof.

Add Subparagraph 3.12.11:

3.12.11 Shop drawings, which in the opinion of the Architect/Engineer have not been fully checked by the Contractor, will not be reviewed by the Architect/Engineer. They will be returned for proper checking by the Contractor. No extension of Contractor completion date will be allowed because of such action by the Architect/Engineer.

Revise Subparagraph 3.15.1:

3.15.1 It shall be the duty of the General Contractor and/or Subcontractor to keep the premises free of accumulations of surplus materials and rubbish caused by his operations and the operations of its subcontractors. Combustible rubbish and debris shall be removed immediately.

Add new Subparagraphs:

3.15.1.1 Each Friday afternoon, and more often if necessary, the General Contractor shall perform an overall cleanup of the entire site, including a broom cleaning of all appropriate surfaces. The trades shall remove their rubbish and debris from the building site to the rubbish collection location promptly upon its accumulation and in no event later than the regular Friday general clean up.

3.15.1.2 Burning of rubbish on site will not be permitted. Rubbish shall not be thrown through window openings or from any great heights, but shall be conducted to ground by means of approved chutes or other means of controlled conveyance.

3.15.1.3 The General Contractor shall provide a suitable location on the site with a sufficient quantity of rubbish bins, and shall be responsible for the removal of rubbish from the site.

- 3.15.1.4 If the Contractor fails to clean up, the Owner may do so, and the cost thereof shall be deducted from monies owed the Contractor.

Revise Subparagraph 3.18.1:

- 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, 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, to the extent caused in whole or in part by 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 which would otherwise exist as to a party or person described in this Paragraph 3.18.

Add Subparagraph 3.18.3 and 3.18.4:

- 3.18.3 "The Contractor agrees to indemnify, defend and hold harmless the Owner from and against any and all administrative and judicial actions (including reasonable attorneys' fees related to any such actions) and judgments incurred by the Owner in connection with any labor related activity arising from the Contractor's performance of the Work. As used in these Contract Documents, "labor related activity" includes, but is not limited to, strikes, walk-outs, informational or organizational picketing, use of placards, distribution of hand-outs, leaflets or other similar acts at or in the vicinity of the Project or in the vicinity of any other facility where the Owner conducts business. The Owner shall advise the Contractor if any labor related activity occurs and the Contractor shall arrange for the legal representation necessary to protect the Owner's interest, provided such representation is approved by the Owner in advance."
- 3.18.4 The Contractor shall indemnify, defend and hold harmless the Owner and the Architect, and their consultants, agents and employees, from and against claims, damages, losses, attorney's fees, and expenses arising out of, or resulting from, any breach, violation or infringement of patent rights, copyrights or other intellectual property rights in connection with the Work, and from any release of hazardous substances on or near the site, except to the extent caused by the Owner.

AMEND ARTICLE 4 AS FOLLOWS:

Add to Subparagraph 4.1.1:

The Architect is FAH Architecture, PLLC, 891 W. Conway Rd., Harbor Springs, MI 49740. telephone (231) 881-8624 and is referred to throughout the Specifications as the A/E or Architect/Engineer and as Architect in AIA Document A101, AIA Document A201 and amendments and supplementary conditions to those documents.

AMEND ARTICLE 5 AS FOLLOWS:

5.2.1. Add the following at the end of Article 5.2.1:

"Notwithstanding the foregoing, Contractor may not substitute any Subcontractor for any of the subcontractors previously identified in the bid process without the express written consent of Owner."

5.2.4. Add the following sentence at the end of Article 5.2.4:

"The Owner may require the Contractor to change any Subcontractor or Sub-subcontractor previously approved and, if at such time the Contractor is not in default hereunder, the Contract Sum shall be increased or decreased by the difference in cost occasioned by such change. The Owner shall document in writing the reasons for which this change is being made and will hold the Contractor harmless from any claim of the subcontractor arising solely from the Owner's requirement to change the subcontractor."

Add Subparagraph 5.2.5:

5.2.5 "Upon request, the Contractor shall provide to the Owner an executed copy of all subcontracts, purchase orders and other agreements relating to the Work."

5.3.1. Add the following new Article 5.3.1:

"Notwithstanding any provision of Article 5.3, any part of the Work performed for the Contractor by a Subcontractor or its Sub-subcontractor shall be pursuant to a written Subcontract between the Contractor and such Subcontractor (or the Subcontractor and its Sub-subcontractor at any tier), which shall be prepared on a form of subcontract satisfactory to the Owner in all respects. Each such subcontract shall, where the context so requires, contain provisions that:

- .1 Require that such Work be performed in accordance with the requirements of the Contract Documents;
- .2 Waive all rights the contracting parties may have against one another or that the Subcontractor may have against the Owner for damages caused by fire or other perils covered by the insurance described in the Contract Documents;
- .3 Require the Subcontractor to carry and maintain insurance coverage in accordance with the Contract Documents, and to file certificates of such coverage with the Contractor;
- .4 Require the Subcontractor to submit certificates and waivers of liens for work completed by it and by its Sub-subcontractors as a condition to the disbursement of the progress payment next due and owing;
- .5 Require submission to Contractor or Subcontractor, as the case may be, of applications for payment in a form approved by the Owner, together with clearly defined invoices and billings supporting all such applications under each subcontract to which the Contractor is a party;
- .6 Report, so far as practicable, unit prices and any other feasible formula for use in the determination of costs of changes in the Work;
- .7 Require each Subcontractor to furnish to the Contractor in a timely fashion all information necessary for the preparation and submission of the reports required herein;
- .8 Require that each Subcontractor continue to perform under its subcontract in the event the Contract is terminated and the Owner shall take an assignment of said subcontract and request such Subcontractor to continue such performance;
- .9 Require each Subcontractor to remove all debris created by its activities; and

.10 Require each Subcontractor to represent that it is an equal opportunity employer."

5.3.2 Add the following provision as a new Article 5.3.2:

"The Contractor shall not enter into any subcontract, contract, agreement, purchase order or other arrangement ("Arrangement") for the furnishing of any portion of the materials, services, equipment or Work with any party or entity without the approval of the Owner."

AMEND ARTICLE 6 AS FOLLOWS:

Delete Subparagraph 6.1.4.

AMEND ARTICLE 7 AS FOLLOWS:

Revise Subparagraph 7.1.3:

7.1.3 Except as permitted in Paragraph 7.3 and 9.7.2, a change in the Contract sum or the Contract Time shall be accomplished only by change order. Accordingly, no course of conduct or dealings between the parties nor express or implied acceptance of alterations or additions to the work and no claim if the Owner has been unjustly enriched by an alteration or addition to the work, whether or not there is, in fact, any unjust enrichment to the work, shall be the basis of any claim to an increase of any amounts due under the contract documents or a change in any time period provided for in the Contract documents.

Add the following paragraph to Article 7:

7.3.11 Add the following provision as a new Article 7.3.11:

"When either the Owner or the Contractor or both do not agree with the determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, such disagreement may be resolved by agreed upon arbitration or, in the absence of agreement, litigation as described in Article 15."

7.5 OVERHEAD AND PROFIT LIMITS

7.5 Contractor shall provide its services under this Agreement in a timely fashion and on a schedule that will allow Substantial Completion of all portions of the Project on or before the agreed upon date in the Project Schedule, and final completion of the Project on or before the agreed upon date in the Project Schedule. The parties agree that time is of the essence. The parties may mutually agree in writing to extend one or both of these dates.

7.5.1 For changes in the Work, the maximum allowable cost for the combined overhead and profit included in the total cost to the Owner shall not exceed 15 percent and shall be subject to the following maximums:

- .1 For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, 5 percent of the amount due the Subcontractor.

- .3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, 10 percent of the cost.
 - .4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.
 - .5 For each Sub-subcontractor involved, for Work performed by the Sub-subcontractors own forces, 5 percent of the cost.
 - .6 All proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized, and where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.
- 7.6 Contractor shall not be paid for work performed prior to the issuance of an applicable change order. Verbal approval of a change order is not permitted, and any work performed on the basis of purported verbal approval shall not be compensated except in the case of a documented emergency.

AMEND ARTICLE 8 AS FOLLOWS:

- 8.3.1 Add the following sentence at the end of Article 8.3.1:

"No such Change Order extending the Contract Time shall result in any increased payments to the Contractor for overhead or extended overhead; nor shall such Change Order result in any increased payments to the Contractor for any other amounts of any nature except if actual additional expenses are shown or if the scope and character of the Work is significantly changed."

- 8.3.2 Add the following sentence at the end of Article 8.3.2:

"A copy of any claim for extension shall be delivered to the Owner, and the Contractor shall immediately take all steps reasonably possible to lessen the adverse impact of such delay on Owner."

- 8.3.3 Add the following sentence at the end of Article 8.3.3:

"In no event shall Owner be liable for delay damages to the extent such delay was caused by or attributable to Contractor or any Subcontractor."

AMEND ARTICLE 9 AS FOLLOWS:

9.1.2 Add the following provision as new Article 9.1.2:

"Notwithstanding anything to the contrary contained in the Contract Documents, the Owner may withhold any payment to the Contractor hereunder if and for so long as the Contractor fails to perform any of its obligations hereunder or otherwise is in default under any of the Contract Documents; provided, however, that any such holdback shall be limited to an amount sufficient in the reasonable opinion of the Owner and the Architect to cure any such default or failure of performance by the Contractor."

Add to the end Subparagraph 9.3.1:

The form of Application for Payment shall be AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, supported by AIA Document G703, Continuation Sheet.

9.3.1 "Such Application for Payment shall be certified as correct by Contractor and shall be accompanied by waivers of liens and other documentation from Subcontractors and Sub-subcontractors as reasonably may be required by the Owner or title insurer. In addition, such Application for Payment shall contain a certification by the Contractor that there are no written claims submitted to the Contractor at the date of such Application for Payment."

Revise Subparagraph 9.3.3:

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 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.

9.5.4 Add the following provision as a new Article 9.5.4:

"If the Contractor disputes any determination by the Architect with regard to any Certificate of Payment, the Contractor nevertheless expeditiously shall continue to prosecute the Work."

9.5.5 Add the following provision as a new Article 9.5.5:

"The Owner shall not be deemed to be in breach of this Contract by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided the Architect has approved the Owner's action or the Work for which payment is being withheld shall have been rejected by any governmental authority.

9.7 Add the following provisions as a new Article 9.7.2:

"Notwithstanding Article 9.7.1, in the event there is a dispute about the accuracy or sufficiency of the Contractor's Application for Payment, Contractor shall not be entitled to stop the Work on account of failure of payment."

9.8.1 Insert after the words "Contract Documents" in Article 9.8.1 the words "and when all required occupancy permits, if any, have been issued".

9.8.2 Add the following provision at the end of Article 9.8.2:

"The Contractor is responsible for the warranty of all Work, whether performed by it or by its Subcontractors at any tier."

Add Subparagraph 9.8.6:

9.8.6 The completed Work shall be without any outstanding or concurrent Work remaining, except as required to complete minor punch list items. The Owner has the sole discretion to determine whether punch list items are "minor". Prerequisites for substantial completion include, (a) receipt by the Owner of all required operation and maintenance documentation, warranties, and completed record drawings; (b) receipt by the Owner of all required products, spare parts, maintenance and extra materials; (c) all systems have been successfully tested and demonstrated by the Contractor for their intended use; and (d) the Owner has received all required certifications and occupancy approvals from the state and local authorities having jurisdiction over the work. Receipt of all certificates and occupancy approvals in and of itself does not necessarily connote substantial completion.

Revise Subparagraph 9.10.2 to replace subclauses (2) and (3) thereof with the following:

"... (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, modified 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 reason that the insurance will not be renewable to cover the period required by the Contract Documents"

Add new Paragraph 9.11:

9.11 RETENTION

9.11.1 Pursuant to Act 524 of the Michigan Public Acts of 1980, the following retention provisions shall apply: The Owner shall retain a portion of each progress payment otherwise due which shall be limited to the following.

- a. Not more than 10% of the dollar value of all work in place until work is 50% in place.
- b. After the work is 50% in place additional retainage shall not be withheld unless the Owner determines the contractor is not making satisfactory progress or for other specific cause relating to the contractor's performance under this contract.

9.11.2 The retained funds shall not be co-mingled with other funds of the Owner and shall be deposited in an interest-bearing account in a regulated financial institution in the State of Michigan wherein all retained funds are kept by the Owner which shall account for both retainage and interest on each construction contract separately.

9.11.3 Except as provided in subparagraphs 9.11.5 below, retainage and interest earned on retainage shall be released to the Contractor together with the final progress payment.

9.11.4 At any time after 94% of the work under this contract is in place and at the request of the original Contractor, the Owner shall release the retainage, plus interest to the original Contractor, only if the original Contractor provides to the Owner an irrevocable letter of credit in the amount of the retainage plus interest issued by a bank authorized to do

business in the State of Michigan, containing terms mutually acceptable to the Contractor and the Owner.

- 9.11.5 If a dispute arises regarding the matter described in the paragraphs immediately above, the Contractor and the Owner agree to submit the dispute to the decision of an agent at the option of the Owner as follows:
- a. The Contractor and the Owner shall designate an agent who has background training and experience in the construction of facilities similar to that which is the subject of the contract as follows:
 - (1) In an agreement reached within ten (10) days after a dispute arises.
 - (2) If an agreement cannot be reached within ten (10) days after a dispute arises the Owner shall designate an agent who has background training and experience in the construction of facilities similar to that which is the subject of the contract and who is not an employee of the Owner.
 - b. The Owner may request dispute resolution by the agent regarding the following:
 - (1) At any time during the term of the contract, to determine whether there has been a delay for reasons that were within the control of the contractor, and the period of time that day has been caused, continued or aggravated by actions of the Contractor.
 - (2) At any time after 94% of the work under the contract is in place, whether there has been an acceptable delay by the Contractor in performance of the remaining 6% of work under the contract. The agent shall consider the terms of the contract and the procedures normally followed in the industry and shall determine whether the delay was for failure to follow reasonable and prudent practices in the industry for completion of the project.
 - c. This dispute resolution process shall be used only for the purpose of determining the rights of the parties of retain funds and interest earned on retained funds and is not intended to alter, abrogate or limit any rights with respect to remedies that are available to enforce or compel performance of the terms of the contract by either party.
 - d. The agent may request and shall receive all pertinent information from the parties and shall provide an opportunity for an informal meeting to receive comments, documents and other relevant information in order to resolve the dispute. The agent shall determine the time, place and procedure for the informal meeting. A written decision and reasons for the decision shall be given to the parties within fourteen (14) days after the meeting.
 - e. The decision of the agent shall be final and binding upon all parties. Upon application of either party, the decision of the agent may be vacated by order of the Circuit Court only upon a finding by the Court that the decision was procured by fraud, duress or other illegal means.
 - f. If the dispute resolution results in a decision:
 - (1) That there has been a delay as described in subparagraph (b.1) above, all interest earned on the retained funds during the period of delay shall become the property of the Owner.
 - (2) That there has been an unacceptable delay as described in subparagraph (b.2) above, the Owner may contract with a subsequent Contractor to complete the remaining 6% of work under the contract, and interest earned on retained funds shall become the property of the Owner. A subsequent Contractor under this subdivision shall be paid by the Owner from the following sources until each source is depleted in the order listed below:

- (i) The dollar value of the original contract less the dollar value of funds already paid to the original Contractor and the dollar value of the work in place for which the original Contractor has not received payment.
 - (ii) Retainage from the original Contractor or funds made available under a letter or credit provided in paragraph 9.11.4 above.
 - (iii) Interest earned on retainage from the original Contractor or funds made available under a letter of credit provided under paragraph 9.11.4 above.
 - g. If the Owner contracts with a subsequent Contractor as provided in subparagraph (f.2), the final progress payment shall be payable to the original Contractor as provided for in the General and Supplementary Conditions. The amount of the final progress payment to the original Contractor shall not include interest earned on retained funds. The Owner may deduct from the final payment all expenses of contracting with the subsequent Contractor. These provisions shall not impair the right of the Owner to bring an action or to otherwise enforce a performance bond to complete work under this construction contract.
- 9.11.6 The aforementioned retention provisions shall not apply if the dollar value of this contract is:
(a) less than \$30,000; or (b) if there will be three (3) or fewer payments.
- 9.11.7 Neither the final payment nor the remaining retained percentage shall become due until the Contractor submits to the Architect or the Owner (1) an affidavit that all payrolls, bills for materials and equipment and other indebtedness connected with the work for which the Owner might in any way be responsible, have been paid or otherwise satisfied, (2) consent of surety, if any, to final payment, and (3) if required by the Owner, other data establishing payment or satisfaction of all such obligations such as receipts, releases and waivers of liens arising out of the contract to the extent and in such form as may be designated by the Owner. If any subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond such lien. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorney's fees.
- 9.11.8 The making of final payment shall constitute a waiver of all claims by the Owner except those arising from (1) unsettled liens, (2) faulty or defective work appearing after substantial completion, (3) failure of the work to comply with the requirements of the Contract Documents, or (4) terms of any special warranties required by the Contract Documents.

AMEND ARTICLE 10 AS FOLLOWS:

Revise Subparagraph 10.1.2:

- 10.1.2 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Architect, 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 in the affected area if in fact the material is asbestos or polychlorinated biphenyl (PCB) 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 or death, or injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Owner, anyone directly or indirectly employed by the Owner or anyone for whose acts the Owner may be liable, and only to the extent not caused by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or

reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Subparagraph 10.1.2.

Add Subparagraph 10.2.19:

- 10.2.9 The Contractor shall notify the Owner and the Architect/Engineer in writing in advance of any hazardous chemical(s) and/or substance(s) that he brings onto the project site or within the existing facilities and shall state where, how, when and length of time said materials will be used.

Add Subparagraph 10.2.10:

- 10.2.10 Should any hazardous materials that were not anticipated be encountered during demolition or construction, the Contractor shall cease all work related to the hazardous materials. The Contractor shall then notify the Owner, who will determine the next course of action.

Add Subparagraph 10.2.11:

- 10.2.11 "If the Contractor fails to give such notices, or fails to comply with such laws, ordinances, rules, regulations and lawful orders, it shall be liable for and shall indemnify and hold harmless the Owner and the Architect, and their respective employees, officers and agents, against any resulting fines, penalties, judgments or damages, including reasonable attorneys' fees, imposed on or incurred by the parties indemnified hereunder."

AMEND ARTICLE 11 AS FOLLOWS:

Revise Subparagraph 11.1.2:

- 11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits of liability or required by law, whichever is greater:

- a. Workmen's Compensation - Statutory
- b. Public Liability

Including coverage for direct operations, sublet work, elevators, contractual liability and completed operations with limits not less than those listed below:

\$ 5,000,000 per occurrence and aggregate for bodily injury and property damage.

The insurance shall be occurrence based rather than on claims made and shall name the Owner as and additional insured.

- c. Comprehensive Automobile Liability

Provide coverage for all owned, non-owned, and hired vehicles. Coverage shall comply with Michigan No-Fault laws, and have minimum limits of liability of \$ 5,000,000 per occurrence, combined single limit, for bodily injury and property damage.

- d. The insurance required above in items b and c, shall name the Owner and Architect, and their respective officers, employees, agents and volunteers as additional insured.

Add to the end of Subparagraph 11.1.3:

"This Subparagraph 11.1.3 shall apply to all insurance required to be maintained by Contractor under the Contract Documents, and not apply to the insurance required under Paragraph 11.1. In addition, the insurance certificates shall be delivered along with a certificate from the agent for the insurer(s), including substantially the following:

This Certificate is being delivered in connection with the Contract between Leelanau County as Owner, and _____, as Contractor, relating to the Leelanau Conservation District Project.

The undersigned has been engaged by the Contractor to arrange for the insurance coverage required under Article 11 of the General Conditions to the Contract Documents. Pursuant thereto, the undersigned is providing, concurrently with this Certificate, the certificate of insurance attached hereto, and hereby represents and warrants to the Owner that the undersigned has reviewed the insurance requirements set forth in Article 11 of the General Conditions, as supplemented and amended, and that the policies of insurance evidenced on the certificates of insurance attached hereto contain all of the coverage, limitations and other provisions required by the Contract Documents."

Delete Subparagraph 11.3.4.

Delete Subparagraph 11.3.9.

Revise Subparagraph 11.3.10:

11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers.

Revise Subparagraph 11.4.1:

11.4.1 The Contractor shall furnish satisfactory payment and performance bonds, each in the amount of 100% of the contract price, as security for the faithful performance and payment of all of the Contractor's obligations under the Contract Documents. The bonds shall be issued by a corporate surety acceptable to the Owner, which is authorized to transact business in Michigan and listed in the current U.S. Department of Treasury Listing of Approved Sureties, Circular 570. All bonds signed by an agent must be accompanied by a certified copy of such agent's Salvation Army to act. If the surety on any bond so furnished is declared bankrupt or becomes insolvent or its right to do business is terminated in Michigan, or it ceases to meet the requirements of this Paragraph, the Contractor shall promptly, but within ten days thereafter, substitute another bond or bonds and surety, subject to the same qualifications as set forth herein.

AMEND ARTICLE 12 AS FOLLOWS:

12.1.2 Insert after the word "Architect", the first time it appears in Article 12.1.2 the words, ", the Owner or any governmental authority".

12.2.1. Insert after the word "Architect", the first time it appears in Article 12.2.1, the words", the Owner or any governmental authority".

AMEND ARTICLE 13 AS FOLLOWS:

Revise the last sentence of Subparagraph 13.5.1 as follows:

"The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded, except as provided in paragraph 13.5.3"

13.5.3 Add to Article 13.5.3, immediately after the word "expenses", the words:

", including the cost of retesting for verification of compliance if necessary, until the Architect certifies that the Work in question does comply with the requirements of the Contract Documents, and all such costs shall not be included in computing the Contract Sum".

Add Paragraph 13.8:

13.8 CONFLICTS IN AGREEMENTS

13.9.1 In the event there is any conflict between Supplementary Conditions and AIA Document A101 and/ or AIA Document A201, the terms of the Supplementary Conditions shall govern.

AMEND ARTICLE 14 AS FOLLOWS:

Revise Subparagraph 14.1.3:

14.1.3 If one of the above reasons exists, the Contractor may, upon seven additional days' written notice to the Owner and Architect without cure, terminate the Contract. If the reason in 14.1.1.3 or 14.1.1.4 exists, the Contractor may recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools and construction equipment and machinery, including reasonable overhead, profit and damages.

Revise Paragraph 14.2:

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 The Owner may, at any time, terminate the Contract in whole or in part for the Owner's convenience and without cause. Termination by the Owner under this Paragraph shall be binding by a notice of termination delivery to the Contractor specifying the extent of termination and the effective date.

14.2.2 Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

- .1 Cease operation as specified in the notice;
- .2 Place no further orders and enter into no further subcontracts for materials, labor, services or facilities, except as necessary to complete the continued portions of the Contract;
- .3 Terminate all subcontracts and orders to the extent they relate to the work terminated;

- .4 Proceed to complete the performance of work not terminated; and
- .5 Seek actions that may be necessary, or that the Owner may direct, for the protection and preservation of the terminated work.

14.2.3 Upon such termination, the Contractor shall recover as its sole remedy, payment for work properly performed in connection with the terminated portions of the work prior to the effective date of termination and for items properly and timely fabricated off the project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, anticipated profits.

14.2.4 The Owner shall be credited for (1) payments previously made to the Contractor for the terminated portion of the work; (2) claims which the Owner has against the Contractor under the Contract; and (3) the value of the materials, supplies, equipment or other items that are to be disposed of by the Contractor that are part of the Contract sum.

14.5 Add the following language as a new Article 14.5:

14.5 **TERMINATION BY OWNER** The Owner may, at its option, terminate any Contract Document which is an agreement for services, in whole or from time to time in part at any time by written notice thereof to the affected party(s). Upon any such termination, an affected party agrees to waive any claims for contract damages, including loss of anticipated profits, on account thereof, and as the sole right and remedy of the affected party, Owner shall pay the affected party in accordance with (c) and (d) below.

The provisions of the Contract, which by their nature survive final acceptance of the Work, shall remain in full force and effect after such termination to the extent provided in such provisions.

- (a) Upon receipt of any such notice, the affected party shall, unless the notice directs otherwise, immediately discontinue the Work on that date and to the extent specified in the notice; place no further orders or subcontracts for materials, equipment, services, or facilities, except as may be necessary for completion of such portion of the Work as is not discontinued; promptly make every reasonable effort to procure cancellation upon terms satisfactory to Owner of all orders and subcontracts to the extent they relate to the performance of the discontinued portion of the Work and shall thereafter do only such Work as may be necessary to preserve and protect work already in progress and to protect materials, plants and equipment on the Site or in transit thereto.
- (b) Upon such termination, the obligations of the Contract shall continue as to portions of the Work already performed and as to bona fide obligations assumed by the affected party prior to the date of termination.
- (c) Upon termination, the affected party shall be entitled to be paid the full cost of all Work properly done by the affected party to the date of termination not previously paid for, less sums already received by the affected party on account of the portion of the Work performed. If at the date of such termination the affected party has properly prepared or fabricated off the Site any goods for subsequent incorporation in the Work, and if the affected party delivers such goods to the Site or to such other place as the Owner shall reasonably direct, then the affected party shall be paid for such goods or materials.

- (d) The affected party shall be reimbursed for any charges incurred for preparation of their work such as preparation of shop drawings, mobilization costs, restocking charges, or retrieval of materials previously delivered to the site or acquired specifically for the Project but not yet incorporated into the Work."

RIDER A - GENERAL CONDITIONS

1. **CONTRACTS:** The CONTRACTOR may let subcontracts in connection with the work and the CONTRACTOR shall properly coordinate the work of such subcontractors. The STATE shall not be liable for any damages or increased costs occasioned by the failure of subcontractors to execute their work as may be anticipated by these documents.
2. **BONDS:** Subcontractors shall furnish in acceptable form, surety bonds in the amount of 100 percent of the contract sum as security for the faithful performance of this contract and for the payment of all persons performing labor and furnishing materials in connection with this contract. The cost of the aforesaid bonds shall be paid by the subcontractors.
3. **CHANGES:** Subcontractors shall make changes in the contracted work only as ordered in writing by the CONTRACTOR.
4. **INSPECTION:** CONTRACTOR shall at all times permit and facilitate inspection of the work by the STATE.
5. **TERMINATION FOR BREACH:** The STATE may terminate this contract when violations are not stopped immediately and corrected within a reasonable length of time after notification.
6. **NONDISCRIMINATION:** For all contracts for goods or services in amount of \$5,000 or more, for contracts entered into with parties employing three or more employees; in connection with the performance of work under this contract, the CONTRACTOR and subcontractors agree as follows:
 - a. The subcontractors will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, age, sex, height, weight or marital status. The subcontractors will take affirmative action to insure that applicants are employed and the employees are treated during employment, without regard to their race, color, religion, national origin, age, sex, height, weight or marital status. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment advertising; layout or termination; rates of pay or other forms of compensation; and selection for training.
 - b. The subcontractors will, in all solicitations or advertisements for employees placed by or on behalf of the subcontractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, age, sex, height, weight or material status.
 - c. The subcontractor will comply with all published rules, regulations, directive and orders of the Michigan Civil Rights Commission relevant to Section 6, 1976 P.A. 453, as amended, which may be in effect prior to taking of bids for the project.

7. PERMITS: The CONTRACTOR and / or subcontractors shall secure from the appropriate agencies ALL REQUIRED PERMITS necessary for proper execution of the work prior to starting work on the project site.

All work shall be executed in accordance with the State of Michigan's Construction Codes, except where work is specified or shown to be above such standard. The work shall be executed in conformity with the drawings and these specifications.

It is the responsibility of the CONTRACTOR to make certain that the drawings and project specifications are in accordance with the applicable laws, statutes, construction codes and regulations.

8. MICHIGAN RIGHT-TO-KNOW LAW: The CONTRACTOR must ensure that subcontractors conform to the provisions of the Michigan Right-to-Know Law, 1986 P.A. 80, which requires employers to: a) develop a communication program designed to safeguard the handling of hazardous chemicals through labeling of chemical containers and development and availability of Materials Safety Data Sheets; b) provide training for employees who work with these chemicals; and; c) develop a written hazard communications program.

The law also provides for specific employee rights. These include: a) the right to be notified (by employer or contractor posting) of the location of Material Safety Data Sheets b) the right to be notified (by employer or contractor posting) of new or revised Material Safety Data Sheet no later than five (5) working days after receipt; and c) the right to request copies of the Material Safety Data Sheet from their employers.

Provision of the State of Michigan's Right-to-Know Law may be found in those sections of the Michigan Occupational Safety and Health Act, which contains Right-to-Know provisions and the Federal Hazard Community Standard, which is part of the Michigan Occupational Safety and Health Act's Right-to-Know Law through adoption.

9. INSURANCE: No work connected with this contract shall be started until the CONTRACTOR has secured evidence from subcontractors of Property Damage Insurance and Public Liability Insurance. The above insurance shall be maintained during the life of this contract. Partial payments shall not relieve the subcontractor from full responsibility for any damage which may result from any cause including fire or other casualty until completion of the contract and final payment. Any casualties shall not relieve the subcontractors from performing the contract.

The CONTRACTOR shall obtain original signed certificates of insurance covering General Liability and Worker's Compensation from each subcontractor immediately after the CONTRACTOR'S Notification of award of the subcontracts.

SECTION 01010

SUMMARY OF WORK

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Project Description.
- B. Building Construction Type and Use Classifications.
- C. Contracts.
- D. Completion of the Work Under this Contract.
- E. The Work.
- F. Work by Owner.
- G. Owner Occupancy.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.
- B. Provisions in Division 1 - General Requirements are applicable to all the Work and are therefore applicable to each section of the specifications.
- C. Additional provisions, which supplement provisions in Division 1 - General Requirements, may be found in Division 22- Plumbing, Division 23 - Mechanical, and Division 26- Electrical and apply to those divisions respectively.

1.03 PROJECT DESCRIPTION

- A. The Project is the Leelanau County Center Lower Level, Environmental Health Department
- B. The Project location is the Leelanau County Government Center, 8527 E. Government Center Drive, Suttons Bay, MI. 49682.
- C. The Work: The project is lower level build out for the Leelanau Conservation District. Furnish all materials, labor and incidental services required to complete and leave ready for operation the interior build out of approximately 2,711 square feet.

1.04 BUILDING TYPE AND USE

- A. The proposed building is classified Type IIIB under the Michigan Building Code 2012
- B. The proposed building addition is Use Group B Business.
- C. Type of Construction shall be Type IIIB.

1.05 CONTRACTS

- A. The Project will be performed under a single contract.

1.06 COMPLETION OF THE WORK UNDER THIS CONTRACT

- A. Unless a particular item of work is specifically indicated to be incomplete or completed by others, all Work is to be completed under this Contract to achieve a totally finished and functioning facility in all aspects. Provide all items necessary (whether specifically indicated in the specifications/drawings or not) to make the Work complete. This includes providing all labor, materials, equipment and services.
- B. "Provide", "furnish", "install", and other similar words (used individually or together) means to execute the Work for the entire process of purchasing the products, transporting the products to the job site, installing the products, making necessary adjustments to the products; unless it is specifically indicated otherwise as "furnish, but do not install" or "install, but do not furnish".

1.07 THE WORK

- A. The Contract Documents in their entirety describe the Work. No individual part or parts of the Contract Documents shall be removed from the context of the entire Contract Documents.
- B. The Work for All Trades: The Contractor shall perform all the Work required by the Contract Documents for All Trades. This generally includes the entire construction of a new facility.
- C. The building will remain occupied during all phases of construction. Install all necessary safety barricades temporary one hour fire partitions and measures to protect the occupants at all times.

1.08 WORK BY OWNER

- A. Work by Owner is work that the Owner will contract for separately: design, drawings, specifications, and work will be by others per separate contract. The following will be work by Owner:
 - 1. Furniture and office equipment.
 - 2. Appliances.
 - 3. Telephone equipment.
 - 4. Non code required Interior and exterior signage.
- B. While this work is excluded from the contract, the Contractor shall coordinate work by Owner with Contractors.

1.09 OWNER OCCUPANCY

- A. Contractor shall coordinate and cooperate with the Owner and Owner's personnel to minimize delay, minimize repetition or errors in layout, and to facilitate Owner's operations.
- B. The Government Center shall remain in operation during construction. The Contractor shall adhere to and maintain all safety and security procedures established by the County.
- C. The project may require off hour construction to maintain the Owners use of the facility. Disruptive noise, dust, odors, etc. shall be minimized considering the Owner's use of the building.

END OF SECTION

SECTION 01028 CHANGE ORDER PROCEDURES

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Documentation of Changes.
- B. Forms.
- C. Proposal Requests.
- D. Change Orders.
- E. Construction Change Directives.
- F. Architect's Supplemental Instructions.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 DOCUMENTATION OF CHANGES

- A. All directions and communication regarding changes in the Work shall be in writing only.
- B. It is the responsibility of the Contractor to see that properly executed written direction for each change in the Work is received before proceeding with any change.
- C. Changes can be issued only by the Architect and authorized only by the Owner.
- D. Proposed changes requested or recommended by the Contractor must be submitted in writing to the Architect, describing the proposed change in the Work, reason for the change, and its affect, if any, on the Contract Sum or Time. Proposed changes requested or recommended by the Contractor must be issued by the Architect and authorized by the Owner before the Contractor proceeds with any such changes.

1.04 FORMS

- A. Forms to be used for the documentation of changes will be designated by Architect.
- B. The term "authorization" as it applies to these forms means the Owner's signature executed in the appropriate location on each complete form.

1.05 PROPOSAL REQUESTS

- A. Proposal Requests will be issued for the purpose of obtaining itemized quotations for proposed changes in the Work which may affect the Contract Sum or Time. If the proposed changes are accepted, they must be issued and authorized in the form of a Change Order before proceeding with any changes.
- B. Contractor will prepare and submit itemized quotations with corresponding supporting documentation within 10 days.

SECTION 01019 CONTRACT CONSIDERATIONS

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Project Phasing
- B. Inspection and Testing.
- C. Schedule of Values.
- D. Application for Payment.
- E. Alternates.
- F. Utility Charges and Permit Fees.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 PROJECT PHASING

- A. The existing Government Center will remain occupied and operational during the lower level interior build out.
- B. The Government Center safety and security must be maintained at all times.
- C. Construction disruption such as noise, dust, odors, etc shall be minimized as much as possible.

1.04 INSPECTION AND TESTING

- A. Furnish test and approval certificates issued by jurisdictional authorities. Provide Architect/Engineer and Owner with written notice of date and time of tests.
- B. The provisions for inspections and tests required by the Contract Documents shall not restrict the Contractor from providing, and paying all costs of, additional inspections and tests he deems necessary to ensure adequate quality of construction, or to comply with inspection and testing requirements of review agencies.

1.05 SCHEDULE OF VALUES

- A. Submit typed schedule of values on and AIA Form G703 - Application and Certification for Payment Continuation Sheet.
- B. The schedule of values shall list the completed value of component parts of the Work. Follow the table on contents as the format for listing the component parts, and list major items within a component part as separate line item value. Contractor's overhead and profit shall be a separate line item. The sum of all values listed in the schedule shall equal the total Contract sum.

- C. As support data, submit a separate list of all subcontractors indicating for each the name of the subcontractor, description of the subcontractor work, and amount of the subcontract.

1.06 APPLICATIONS FOR PAYMENT

- A. The payment period shall be 30 days.
- B. Submit a minimum of three copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA Form G703 - Application and Certification for Payment Continuation Sheet.
- C. Utilize Schedule of Values for listing items in Application and Certification for Payment Continuation Sheet.
- D. Submit all partial and full waivers of lien with each application for the previous payment period.
- E. Retention provisions are listed in Document 00800 - Supplementary Conditions.

1.07 ALTERNATES - NOT USED

1.08 UTILITY CHARGES AND PERMIT FEES

- A. Owner will directly pay for utility tap or hookup fees for permanent utilities. The General Contractor shall coordinate any submittals to the appropriate municipalities and utility companies for determining the utility charges. The General Contractor shall also coordinate schedules with appropriate municipalities and utility companies for the installation, connection, and activation of the utilities.
- B. Permit fees, building permits, etc. shall be paid by the General Contractor as indicated in AIA Document A201 (Subparagraphs 3.7) and Supplementary Conditions 00800 (Subparagraphs 3.7.5). Plan review fees, if required by the local building authority will be paid by the Owner.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

- C. Form to be used for the documentation of proposed changes for the purpose of obtaining itemized quotations will be AIA Document G709 - Proposal Request (2017 Edition).

1.06 CHANGE ORDERS

- A. Change Orders will be issued for the purpose of ordering changes in the Work that may affect the Contract Sum or Time. Change Orders are not valid until authorization by the Owner. After authorization the Work shall proceed.
- B. Form to be used for the documentation of changes in the Work that affects the Contract Sum or Time will be AIA Document G701 - Change Order (2017 Edition).

1.07 CONSTRUCTION CHANGE DIRECTIVES

- A. Construction Change Directives will be issued for the purpose of ordering changes in the Work that may affect the Contract Sum or Time, but exact changes to the Contract Sum or Time may not be known at the time of issue. Construction Change Directives are not valid until authorized by the Owner. After authorization, the Work shall proceed and be included in a subsequent Change Order.
- B. Form to be used for the documentation of directed changes will be AIA Document G714 - Construction Change Directive (2017 Edition).

1.08 ARCHITECT'S SUPPLEMENTAL INSTRUCTIONS

- A. Architect's Supplemental Instructions will be issued for the purpose of ordering minor changes in the Work that do not affect the Contract Sum or Time. After acceptance by the Contractor the Work shall proceed. Architect's Supplemental Instructions do not require authorization by the Owner.
- B. Form to be used for the documentation of minor changes that do not affect the Contract Sum or Time will be AIA Document G710 - Architect's Supplemental Instructions (2017 Edition).

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01040 COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Coordination.
- B. Examination.
- C. Job Site Administration.
- D. Request for Information.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 PROJECT COORDINATION

- A. Coordinate scheduling of Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements. Coordinate Work of various Sections with that of other Sections, which require attachment of components. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service.
- B. Coordinate submittals to assure efficient and orderly sequence of installation of interdependent construction elements.
- C. Verify that utility requirements of operating equipment are compatible with building utilities.
- D. Verify and coordinate placement of bearing support items.
- E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and cleanup of the Work of separate Sections in preparation for Substantial Completion.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.04 EXAMINATION

- A. Verify that field conditions, surfaces, and prepared openings are acceptable and are ready to receive work.

- B. Verify that surfaces are smooth and flat within maximum variation recommended for installation of products and that surfaces are ready to receive Work.
- C. Verify that substrate, and adjacent materials are dry as required for products or adhesives.
- D. Verify items provided by other Sections of work are properly sized and located. Verify foundations, pads, pits, and position of anchor bolts and other anchoring devices are in the proper location and of proper size.
- E. Field measure to verify that dimensions are as shown on Drawings, shop drawings, and as instructed by product manufacturer.
- F. Verify that mechanical, electrical, telephone, plumbing and other building items affecting work are placed and ready to receive this work and that all substrate penetrations are complete.
- G. Confirm electrical power is available and of correct characteristics as required for installed equipment.
- H. Report defects of deficiencies in writing.
- I. Verify truss spaces are unobstructed to allow placement of blown-in insulation.
- J. Verify block cores are free of mortar to allow free flow of granular insulation. Verify holes and openings have been sealed to prevent escape of insulation.
- K. Beginning of installation means acceptance of existing conditions.

1.05 JOB SITE ADMINISTRATION

- A. Contractor shall employ a superintendent as required by the General and Supplementary Conditions of the Contract between the Owner and Contractor.
- B. Provide the Architect/Engineer and Owner with written notification of the superintendent's name and job trailer telephone and fax numbers within 7 days of their determination.
- C. Contractor shall prepare a typewritten alphabetized list of subcontractors and suppliers to be used on the project. The list shall contain company name, company address, name of contact person, telephone and fax numbers, and the portion of the Work to perform.
- D. Provide the Architect/Engineer and Owner with a copy of the subcontractor and supplier list within 7 days of notice to start work and periodically update as required by changes to information in the list.

1.06 REQUEST FOR INFORMATION

- A. Direct all questions in writing to FAH Architecture, PLLC by US Mail or by email to f_hackl@yahoo.com.
- B. The Request for Information form following this Section of the Project Manual shall be used for all questions and required clarifications.
- C. Contractor shall be responsible for assigning Request for Information numbers, and maintaining and publishing once per month a log of all requests. Log shall include a listing of request numbers, request dates, response dates, and brief descriptions of the requests.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

FAH ARCHITECTURE, PLLC
REQUEST FOR INFORMATION

Project Name: Leelanau County Government Center Lower Level Environmental Health Department Space

Requested By: _____ Request No.: _____

Company: _____ Telephone No.: _____

Date: _____

Requested Information:

Response:

cc: Project File _____ Answered By: _____

..... Company:

_____ Date: _____

SECTION 01045 CUTTING AND PATCHING

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Procedure.
- B. Quality Control.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 PROCEDURE

- A. The Contractor shall coordinate all cutting and patching requirements among the Subcontractors.
- B. Subcontractors must have approval of the Contractor before all cutting.
- C. The Contractor must submit a written request and have approval of the Architect/Engineer before cutting or altering elements which affect:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Work of Owner or separate contractor.
- D. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- E. Execute Work by methods, which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.
- F. Cut rigid materials using masonry saw or core drill.
- G. Restore Work with new Products in accordance with requirements of Contract Documents.
- H. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. Maintain integrity of wall, ceiling, or floor construction, completely seal voids.

- J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection. For an assembly, refinish entire unit.
- K. Identify any hazardous substance or condition exposed during the Work to the Architect/Engineer for decision or remedy.

1.04 QUALITY CONTROL

- A. Patching must restore the cut area to original or better condition with no detectable evidence that the area has been patched.
- B. Cutting and patching must be done by personnel qualified in the execution of work for the appropriate affected trade. Wherever possible, patching of work shall be done by the original installer of that work, especially when cutting and patching will affect the terms of product warranties.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01050 FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Scope of Engineering Services.
- B. Qualifications.
- C. Certification.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 SCOPE OF ENGINEERING SERVICES

- A. Provide all engineering services necessary for the proper execution and completion of the Work and as otherwise required by the Contract Documents. Engineering services provided by the Contractor shall not be authorized to make any changes in the Contract Documents.
- B. Engineering services provided by the Contractor may generally include, but are not necessary limited to: building and site layout, design of temporary structures and facilities during construction; design for all construction field procedures; performance of monitoring, testing, and reports; design and preparation of shop drawings and pre-engineered items; design of construction programs, processes, and facilities to meet legal and safety requirements. {This general description specifically includes, but is not limited to, temporary shoring and bracing for excavation and for construction, temporary control of ground and surface water, temporary handrails and guardrails, and scaffolding.}
- C. The Contractor shall provide for the location and protection of survey control and reference points. Control datum for survey is indicated on Drawings.
- D. The Contractor shall provide for establishment of elevations, lines, and levels using recognized engineering survey practices.
- E. Submit a copy of registered site drawing and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.

1.04 QUALIFICATIONS

- A. Engineers must be licensed to practice in the state in which the Project is being constructed as acceptable to the building official having jurisdiction over the Project.
- B. Engineers must be qualified and experienced in the discipline and scope of the Work required and acceptable to the Architect/Engineer.

1.05 CERTIFICATION

- A. Where submittals are required to be prepared by, or under the direct supervision of, licensed personnel (Architect, Land Surveyor, Professional Engineer, etc.), each submittal shall bear the seal and signature of the licensed person in responsible charge.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01060 REGULATORY REQUIREMENTS

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Applicable Requirements.
- B. Rated Construction.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 APPLICABLE REQUIREMENTS

- A. The Contractor shall comply with all laws, ordinances, rules, orders and regulations of local, state, federal and other authorities relating to the execution of the Work.

1.04 RATED CONSTRUCTION

- A. For rated construction, provided appropriate products that are tested and labeled to assure compliance with system requirements for rating.
- B. Where specific assembly identification is given, use exact assembly indicated.
- C. Where specific assembly identification is not given, submit identification of assemblies to be used which meet the ratings and details required by the Contract Documents, and are acceptable to the review agency having jurisdiction.
- D. Provide labels, affidavits, and other such identification to verify compliance when requested.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01090 REFERENCES

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Applicable Editions.
- B. List of Reference Standards.
- C. Federal Government Agencies.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 APPLICABLE EDITIONS

- A. Unless specifically indicated otherwise, comply with editions of referenced standards that are the most current, effective as of the date of the Contract Documents.
- B. References to methods of measurement or payment in reference standards are not applicable.
- C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference standards.
- D. Obtain copies of standards when required by Contract Documents and maintain a copy on site as required by individual Sections.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.04 LIST OF REFERENCE STANDARDS

AA	Aluminum Association
MBC	Associated Air Balance Council
MMA	American Architectural Manufacturer's Association
MSHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ACPA	American Concrete Pipe Association
ADC	Air Diffusion Council
AGA	American Gas Association
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALI	Associated Laboratories
ALSC	American Lumber Standards Committee
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute

APA	American Plywood Association
ARI	Air Conditioning and Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASA	Acoustical Society of America
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning and Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society of Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association
BIA	Brick Institute of America
CISPI	Cast Iron Soil Pipe Institute
CRI	Carpet and Rug Institute
CRSI	Concrete Reinforcing Steel Institute
CTI	Ceramic Tile Institute of America
DHI	Door and Hardware Institute
DLPA	Decorative Laminate Products Association
EIA	Electronic Industries Association
ETL	ETL Testing Laboratories, Inc.
FGMA	Flat Glass Marketing Association
FM	Factory Mutual Engineering and Research
GA	Gypsum Association
HMA	Hardwood Manufacturers Association
IEEE	Institute of Electrical and Electronic Engineers
IGCC	Insulating Glass Certification Council
MBMA	Metal Building Manufacturers Association
MCAA	Mechanical Contractors Association of America
MUSFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAPA	National Asphalt Pavement Association
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NECA	National Electrical Contractors Association
NEII	National Elevator Industry, Inc.
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
N.F.P.A.	National Forest Products Association
NHLA	National Hardwood Lumber Association
NPA	National Particleboard Association
NPCA	National Paint and Coatings Association
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWWDA	National Wood Window and Door Association
PCI	Prestressed Concrete Institute
RFCI	Resilient Floor Covering Institute
SDI	Steel Deck Institute
S.D.I.	Steel Door Institute
SGCC	Safety Glazing Certification Council
SJI	Steel Joist Institute

SMACNA Sheet Metal and Air Conditioning Contractors National Association
SPRI Single Ply Roofing Institute
UL Underwriters Laboratories
WWPA Western Wood Products Association
W.W.P.A. Woven Wire Products Association

1.05 FEDERAL GOVERNMENT AGENCIES

CE Corps of Engineers
CS Commercial Standard
DOC Department of Commerce
DOT Department of Transportation
EPA Environmental Protection Agency
FHA Federal Housing Administration
FS Federal Specification
GSA General Service Administration
MIL Military Standardization Documents
NBS National Bureau of Standards
OSHA Occupational Safety and Health Administration

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01200 PROJECT MEETINGS

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Attendance.
- B. Pre-construction Meeting.
- C. Progress Meetings.
- D. Pre-installation Conferences.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 ATTENDANCE

- A. The Contractor must attend all project meetings and be represented by the superintendent and any other personnel required to accomplish the purpose of the meetings.
- B. The Contractor shall arrange for the attendance of the Subcontractors and other interested parties as determined necessary or as requested by the Owner or the Architect.
- C. Each representative in attendance must have the authority to make binding decisions and obligations on behalf of their respective organizations.

1.04 PRE-CONSTRUCTION MEETING

- A. A pre-construction meeting will be held after award of the Contract and before commencement of construction. Time and place of the meeting will be determined by the Architect.

1.05 PROGRESS MEETINGS

- A. The Contractor shall schedule progress meetings at one month intervals to report to the Owner and the Architect the progress of the Work and to discuss pertinent issues relative to the proper and timely execution of the Work. Meeting schedule shall accommodate Owner and Architect's schedule.
- B. The Contractor shall provide an appropriate meeting place at the job site to accommodate the number of people attending.
- C. The Contractor shall conduct the progress meetings, prepare agenda with copies distributed in advance of the meetings, record and distribute the minutes of the meetings to the Owner and the Architect/Engineer. The Contractor shall also make copies of the minutes and distribute them to all Subcontractors and other interested parties as appropriate.
- D. The Contractor shall arrange for and conduct separate meetings on the same day to be attended by major Subcontractors, Suppliers and other interested parties as appropriate to agenda topics for each meeting. The Contractor shall prepare agenda with copies

distributed in advance for participants, record and distribute the minutes of the meetings to the Owner and Architect/Engineer, and Subcontractors and Suppliers affected by decisions made during the meeting.

1.06 PRE-INSTALLATION CONFERENCES

- A. When required due to the complexity of the Work, convene a pre-installation conference at the work site prior to commencing that work. Intent of the pre-installation conference is to review conditions of the installation, preparation and installation procedures, and coordination with related work.
- B. Require attendance of parties directly affecting, or affected by, such Work.
- C. Notify Architect/Engineer seven days in advance of meeting date.
- D. Prepare agenda, preside at conference, record minutes and distribute copies to participants and Architect/Engineer.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01300 SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Information for Contractor's Use.
- B. Submittals.
- C. Submittal Identification.
- D. Time of Submittals.
- E. Content.
- F. Contractor's Review.
- G. Architect's Review.
- H. Shop Drawings.
- I. Product Data.
- J. Samples.
- K. Manufacturers' Certificates.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 INFORMATION FOR CONTRACTOR'S USE

- A. The Contractor shall obtain all shop drawings, product data, and samples necessary for the proper execution of the Work.
- B. The Contractor shall obtain all information available for each manufacturer/supplier for their respective products being used in the Work.
- C. The Contractor shall read all information to arrive at a clear understanding of how each product is to be incorporated into the Work. The Contractor shall obtain additional technical assistance from the manufacturer/supplier as necessary to achieve such understanding.
- D. The Contractor shall distribute appropriate information to other entities involved in the execution of their applicable portions of the Work.

1.04 SUBMITTALS

- A. The Contractor shall submit to the Architect the shop drawings, product data, and samples which are requested for submittal.

- B. The Contractor shall submit to the Architect specific written notification of any item or portion of the Work proposed which varies from the Contract Documents, before such item is incorporated in the Work. The Architect will rely on the Contractor having complied with the Contract Documents in their entirety except where written notification of variance has been submitted to the Architect and the Architect has issued written notification to proceed with the proposed variance under change order procedures.
- C. Provide space for Contractor and Architect/Engineer review stamps.
- D. On revised and resubmitted submittals, identify all changes made since previous submittal.
- E. The Contractor shall retain one set of all submittals at the job trailer available to the Architect/Engineer, Owner, and Building Official until completion of the project.

1.05 SUBMITTAL IDENTIFICATION

- A. All submittals shall be accompanied by a letter of transmittal stating the date, the project name, the Architect's project number, the Owner, the Contractor, the Subcontractor or supplier, the Architect, the item being submitted, the number of copies, the purpose of the submittal, the five-digit specification section number, and any other pertinent information.

1.06 TIME OF SUBMITTALS

- A. Schedule submittals to expedite the Project. Coordinate submittals of related items and for interfacing work.
- B. All submittals which are required for the selection of materials, finishes, colors, etc. shall be submitted at the same time. No selection will be made by the Architect for any one item until all items are available for concurrent review and coordination. Submittals shall be made no later than 30 days after the date of commencement of the Work.

1.07 CONTENT

- A. Submittals shall contain sufficient detail so as to describe the item and show compliance with the Contract Documents, and to provide all additional information required to incorporate the item into the Work.
- B. Drawing shall be professionally drafted and presented in the most appropriate scale (sufficiently large enough) to clearly communicate the information therein.
- C. Samples shall be actual physical products in as large of size as is normally available for each item. For products which may have a range in color, or finish, or texture, submit adequate number of samples to show the entire range.

1.08 CONTRACTOR'S REVIEW

- A. Apply Contractor's stamp and signature on each submittal certifying that review and verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- B. Submittals will not be reviewed by the Architect without prior review and verification stamp by the Contractor.

- C. Submittals rejected by the Contractor shall not be forwarded to the Architect except upon special request.

1.09 ARCHITECT'S REVIEW

- A. Architect's review shall be verified on each submittal with a stamp and signature.
- B. Architect's stamp shall have the following choices to be selected as most appropriate:
 1. "REVIEWED" - Indicates that no corrections have been noted. No deviations from the Contract Documents are approved. Affected portions of the Work may commence in strict compliance with the Contract Documents.
 2. "REVIEWED AS NOTED" - Indicates that some corrections have been noted. No deviations from the Contract Documents are approved. Affected portions of the Work may commence in strict compliance with the Contract Documents.
 3. "REVISE AND RESUBMIT" - Indicates that some corrections have been noted which will require further review. Affected portions of the Work may not commence. Make all necessary revisions and resubmit.
 4. "REJECTED" - Indicates major non-commence. The Contractor shall contact the Architect to obtain a better understanding of the requirements of the Contract Documents. Affected portions of the Work may not commence. Make a new submittal that is in compliance with the Contract Documents.

1.10 SHOP DRAWINGS

- A. Submit shop drawings in the form of one reproducible transparency and three opaque reproductions. The Architect/Engineer will return the reproducible transparency, retain two reproductions, and distribute one reproduction to the Owner.
- B. After review, reproduce and distribute in accordance with preceding procedures and for Record Documents described in Section 01700 - Contract Closeout.
- C. Structural shop drawings shall bear the seal of a Professional Engineer registered in the State of Michigan.
- D. Shop drawings shall include as appropriate for product:
 1. Members: Sizes, spacing, attachments and fasteners, cambers, loads, connections, design calculations, and locations and size of openings. Include erection drawings, elevations, and details where applicable. Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.
 2. Fabrication: Profiles, sizes, dimensions, connections, attachments, anchorage, size and type of fasteners, and accessories. Include plans, elevations, and details as required to fully describe work.
 3. Finishes: Indicate finishes including decorative laminate, paint color, stain and sealer, and other finishes. Obtain approval for finishes before ordering.
 4. Hardware: Profiles, sizes, function, dimensions, grade, finish, and attachment.

1.11 PRODUCT DATA

- A. For manufacturers standard printed literature and samples, submit five copies. The Architect/Engineer will return two copies, retain two copies, and distribute one copy to the Owner. Literature shall be nearly bound. Clearly mark each copy to identify applicable

products, models, options, and other data. Supplement the manufacturers' standard data to provide information unique to the Project.

- B. After review, distribute in accordance with preceding procedures and for Record Documents described in Section 01700 - Contract Closeout.

1.12 SAMPLES

- A. For products requiring Architect/Engineer's approval submit three sets of samples. The Architect/Engineer will return one set of samples, retain one set of samples, and distribute one set of samples to the Owner.
- B. Submit four sets of samples for items specified as "finish selected by Architect/Engineer", samples shall indicate colors, textures and patterns available.
- C. Samples shall illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices.
- D. Reviewed samples which may be used in the Work are indicated in individual specification Sections. None of these samples shall be retained by the Architect/Engineer.

1.13 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturers' certificate to Architect/Engineer for review, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not used

END OF SECTION

SECTION 01310 PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Progress Schedule.
- B. Progress Report.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 PROGRESS SCHEDULE

- A. Submit a detailed progress schedule which shows both projected and completed work. Form of schedule shall be either bar graph or CPM chart at the Contractor's option.
- B. The schedule shall show all of the work to be done divided into specific categories. Each category shall be narrow in scope so as to describe a single task with an identifiable time period in which that task is to be completed.
- C. The schedule shall be updated monthly and be submitted with each application for payment.
- D. The schedule shall be used to help evaluate the progress of the work toward timely completion. If the work falls behind schedule, the Contractor shall implement a plan to bring the progress of the work back up to schedule. All steps taken to maintain completion as scheduled (additional labor force, overtime, expedited material handling, substitutions, etc.) shall be at no additional cost to the Owner.

1.04 PROGRESS REPORTS

- A. Prepare a monthly progress report to be submitted with each application for payment. Report shall indicate the work completed in the previous month to date and the work scheduled for the next month. State whether project is ahead of schedule, on schedule, or behind schedule, and a projected date of completion. Include any other specific items of concern related to the progress of the work.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01400 QUALITY CONTROL

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Laying Out Work.
- B. Quality Assurance and Control of Installation.
- C. Mock-up.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 LAYING OUT THE WORK

- A. The General Contractor shall locate general reference points, lay out Work and be responsible for all lines, elevations and measurements of the building, utilities and other work executed by him under the Contract. He must exercise proper precaution to verify figures on the Drawings before laying out Work and will be held responsible for any error resulting from his failure to exercise such precaution.
- B. The General Contractor shall make provision to preserve property line stakes, bench marks or datum point. If any are lost, displaced, or disturbed through neglect of the Contractor, his agents or employees, he shall pay the cost of restoration.
- C. Each contractor before commencing work shall verify grades, lines, levels, locations, and dimensions and shall examine spaces, surfaces and areas indicated on Drawings to receive his work. Commencing work implies acceptance of existing conditions.
- D. Verify all dimensions shown on the Drawings and obtain all measurements required for proper execution of work. Verify before beginning construction in areas indicated to be barrier free that all dimensions and fixtures comply with requirements of Michigan Barrier Free Design Law and the Americans with Disabilities Act.
- E. Information pertaining to preliminary investigations such as the survey, location of utilities, existing structures, and existing grades appear on the Drawings. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing or that unforeseen developments may not occur. Each contractor must put his own interpretation on results of such investigation and shall satisfy himself as to materials upon which his work may be placed. Where underground services, utilities, structures, etc. are located on the Drawings or given at the site they are based on the available records but are not guaranteed to be complete or correct. They are merely given to assist each contractor.

1.04 QUALITY ASSURANCE AND CONTROL OF INSTALLATION

- A. The Contractor shall maintain a program of quality control monitoring for all the Work. Provide additional support personnel (such as manufacturers' representatives, consultants, recognized technical experts, etc.) who are required or requested to observe, direct, or evaluate the Work.

- B. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- C. Comply fully with manufacturers' instructions, including each step-in sequence.
- D. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- F. Perform work by persons qualified to produce workmanship of specified quality. Employ personnel licensed or approved by manufacturer when such employment is a condition of manufacturer's warranty.
- G. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.05 MOCK-UP

- A. Mock-up shall be erected and Architect/Engineer shall be given notification that mock-up is prepared for approval. Notification shall be made 14 days prior to scheduled beginning of work contained in mock-up.
- B. Assemble and erect specified items, with specified attachment and anchorage devices, flashing, seals, and finishes.
- C. Where mock-ups are used, they shall be maintained until completion of the Work for the purpose of a standard of quality to be met.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities.
- B. Temporary Controls.
- C. Field Offices.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 SCOPE

- A. The Contractor shall provide all construction facilities and temporary controls which are necessary for the execution of the Work and as otherwise required by the Contract Documents.
- B. Remove all temporary items when no longer needed.

1.04 EXISTING SITE UTILITIES

- A. Owner's utilities which currently exist at the site (which may include electric, gas, water) may be used for construction in reasonable amounts by the Contractor, and will be paid directly by the Owner to the utilities agency.

1.05 TEMPORARY ELECTRICITY

- A. Provide and pay for electric service, distribution, and lighting.
- B. Use of electrical system which is part of the new Work is allowed, but shall be limited to small hand tools which will not trip breakers.

1.06 TEMPORARY LIGHTING

- A. Provide and maintain lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may not be utilized during construction.

1.07 TEMPORARY HEATING, COOLING, AND VENTILATION

- A. Provide and pay for heating, cooling, and ventilating. Temperature and humidity must be appropriate for installation and protection of the materials being used.

- B. Maintain a constant temperature range (minimum 60 degrees, maximum 90 degrees, and more specific as required by individual materials) before, during, and after the installation of finish materials such as floor tile, carpet, paint, wall covering, ceilings, woodwork, etc.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. No part of the new building system may be used until after construction has progressed to the point where no dust, dirt, pollutants, contaminants, odors, etc. will be circulated through the system, and written permission is received from the Architect.

1.08 TELEPHONE SERVICE

- A. Provide, maintain and pay for telephone and fax service to field office at time of project mobilization.

1.09 TEMPORARY WATER SERVICE

- A. Provide, maintain and pay for potable water at the job site for drinking and construction purposes. Provide and remove temporary branch piping with outlets located so water is available by hoses with threaded connections as required for construction.

1.10 TEMPORARY SANITARY FACILITIES

- A. Provide, maintain and pay for required facilities and enclosures at the job site. Coordinate placement of temporary facilities with Owner.

1.11 TEMPORARY FIRE PROTECTION

- A. Provide, maintain and pay for fire protection at the job site.

1.12 BARRIERS AND ENCLOSURES

- A. Provide and maintain appropriate barriers, e.g., a fence, around perimeter of Work to prevent unauthorized entry into construction and staging areas.
- B. Provide and maintain appropriate barricades for the protection of the site, stored materials, existing structures, adjacent properties, and vehicular traffic.

1.13 SECURITY

- A. The construction site shall be kept secure at all times so as to allow only authorized personnel on to the site.

1.14 ENVIRONMENTAL CONTROLS

- A. Provide for the control of dust, dirt, erosion, moisture (water, snow, ice, vapor), noise, pollution, and other potentially harmful or irritating conditions encountered during construction. Environmental control applies to the entire site: exterior, interior, new construction, and existing facilities.

1.15 TRAFFIC CONTROLS

- A. Provide flagmen, signs, lights, and other temporary facilities required for the control of traffic.

- B. Parking and staging shall be within the construction limits unless otherwise authorized by the Owner.

1.16 WATER CONTROL

- A. Maintain excavations free of water.
- B. Protect site from puddles or running water. Provide water barriers as required to protect site from soil erosion and to prevent damage to existing site unaffected by work of this contract.

1.17 EXTERIOR ENCLOSURES

- A. Provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.18 PROTECTION OF INSTALLED WORK

- A. Protection of installed Work shall be the Contractors responsibility until the time of substantial completion.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect installed materials that are susceptible to damage from sunlight or precipitation from prolonged exposure to these conditions until material is covered by successive work.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from entering landscaped areas.

1.19 SAFETY

- A. Provide easy access to the entire building for the public fire department and maintain unobstructed and free passage for egress from the building(s).
- B. Provide and maintain the required amount of fire extinguisher and familiarize all persons working on the project with their location and operation.
- C. Flammable liquids shall not be stored within the building. Paint thinners and gasoline should be handle inside the building only in approved safety containers.
- D. Provide and maintain shoring and bracing to prevent earth from caving or washing into the project excavations, and to protect existing underground utilities, sewers, etc., encountered during excavation work from collapse or other type of damage.

1.20 FIELD OFFICES

- A. Provide a field office at the job site to accommodate the Contractor's needs and obligation of the Contract Documents, and for use by the Owner and Architect while at the job site. Among other things, the field office must be suitable for the keeping of the project record copy documents and for the conducting of project meetings (conditioned space 65 degrees to 75 degrees, electrical power and lighting, telephone, desk and file space, table and chairs).

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01600 MATERIAL AND EQUIPMENT

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Products.
- B. Transportation and Handling.
- C. Storage and Protection.
- D. Product Options.
- E. Items Not Specified.
- F. Substitutions.
- G. Color Selections.
- H. Installation.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Products other than those specified by manufacturer made of recycled or reused materials must be approved by Architect/Engineer. Submit manufacturers or suppliers certification of performance with request for approval.

1.04 TRANSPORTATION AND HANDLING

- A. Transport and handle Products in accordance with manufacturer's instructions.
- B. Deliver products wrapped and crated in manufacturer's original shipping packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing, in a manner to prevent damage to components or marring of surfaces. Mark each package for installation location.
- C. Package hardware items individually; label and identify package with door opening code to match hardware schedule. Deliver keys to Owner by security shipment direct from hardware supplier.
- D. Transport products to prevent twisting warping or detrimental exposure to elements.

- E. Promptly inspect shipments to assure that Products comply with requirements, quantities are correct, and Products are undamaged.
- F. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage. Lifting or handling equipment shall be capable of supporting products in positions anticipated during storage, transportation, and erection.
- G. File required claims for Products damaged in transport.
- H. Take appropriate action to correct deficiencies in a timely fashion so as not to cause delay of the Work.

1.05 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store temperature sensitive products for 24 hours prior to application within temperature range as recommended by the manufacturer for best workability.
- C. For exterior storage of fabricated Products, place on sloped supports, above ground.
- D. Store preformed and manufacturer finished material in a clean, dry area, stack flat, prevent twisting, bending, or abrasion, blocked off ground to prevent sagging, and to provide ventilation. Prevent contact during storage with materials which may cause discoloration, staining, or damage.
- E. Provide off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation. Store organic and porous materials off ground in ventilated and protected manner to prevent deterioration from moisture.
- G. Store sensitive Products in weather-tight, climate controlled enclosures. Store loose granular materials on solid flat surfaces in a well-drained area; prevent mixing with foreign matter. Store cementitious materials and aggregates in manner to prevent wetting, deterioration or intrusion of foreign materials.
- H. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of Products to permit access for inspection. Periodically inspect to assure Products are undamaged and are maintained under specified conditions.
- J. Store ferrous items off the ground and in a manner to prevent damage to the corrosion resistant coatings.
- K. Protection is to be all-inclusive and, among other things, includes protection against natural causes such as moisture (water, snow, ice, condensation, etc.), wind, temperature, sunlight, dirt, dust, etc., and protection against man-made causes.

1.06 PRODUCT OPTIONS

- A. Design is generally based on product of first manufacturer named.

- B. Provide products from specific manufacturers as applicable. The naming of a manufacturer indicates that the general quality of work produced by that manufacturer is acceptable, but does not necessarily mean that each manufacturer's specific product meets all requirements of the Contract Documents. Select a manufacturer whose product does meet all requirements of the Contract Documents.
- C. Where no manufacturer is specified, use any manufacturer's product which meets or exceeds the requirements of the Contract Documents.
- D. Where one or more manufacturers is specified, use one of the specified manufacturer's products which meets or exceeds the requirements of the Contract Documents.
- E. If a manufacturer's standard product does not meet all the requirements of the Contract Documents, the product shall be modified and supplied as a custom made item by the manufacturer.
- F. Where one manufacturer's specified product is specified (by name, model number, series, etc.), the products of other listed manufacturers are acceptable only if they meet all the standard set by the products specified and the rest of the Contract Documents.
- G. Products specified (by name, model number, series, etc.) may still need additional modifications and/or options to comply with the Contract Documents. Provide products that include all these necessary adjustments.
- H. Within 10 days after the date of commencement of the Work, submit a list of all products to be used which identifies the names of the manufacturer, supplier, and installer.

1.07 ITEMS NOT SPECIFIED

- A. For items which are not specified but are required to properly complete the Work, provide items of quality and scope appropriate for the Project.

1.08 SUBSTITUTIONS

- A. The materials, products and equipment described in the Contract Documents establish a standard of required function, dimension, appearance and quality that may, in some cases, be met by a proposed substitute.
- B. No substitution will be considered prior to receipt of Bids unless written request from a Bidder for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitute would require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.
- C. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.
- D. No substitutions will be considered after the Contract award unless specifically provided in the Contract Documents.

- E. Substitutions shall not alter the design intent of the Contract Documents.
- F. Substitutions shall be equal to or exceed the specified materials, products and equipment as determined by the Architect/Engineer.
- G. Alteration to the Work required by approved substitution shall be the responsibility of the Contractor.

1.09 COLOR SELECTIONS

- A. Color selections for any product will be selected (by the Architect) from a full range of all standard, and premium, and shall not be limited in the number of different colors selected, unless specifically indicated otherwise in the specification sections for each product.

1.10 INSTALLATION

- A. Installation of material and equipment shall be in accordance with the requirements of the Contract Documents and the manufacturer's requirements and recommendations for specific products.
- B. Inspect all work for proper installation and operation. Record inspections in written reports, and submit reports when requested.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not used

END OF SECTION

SECTION 01650 FACILITY STARTUP/COMMISSIONING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General Procedures.
- B. Specific Procedures.
- C. Records.
- D. Starting Systems.
- E. Testing, Adjusting, and Balancing.
- F. Manufacturer's Instruction.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 GENERAL PROCEDURES

- A. Facility startup includes (but is not limited to) requirements for putting the Project in operating order such as starting systems, operating equipment, testing to ensure correct operation and function, demonstration, training, and verification.
- B. Schedule startups at least two weeks in advance with all parties involved. This may include representatives of the Owner, Architect, Engineer, Contractor, subcontractor, supplier, manufacturer, and others as appropriate.
- C. Where Owner's operating personnel are available, provide training to the level of expertise required to properly operate and maintain systems and equipment. Owner's operating personnel shall be assumed to be competent to operate the types of systems and equipment installed on this Project (Owner shall be notified if the Contractor has reason to believe otherwise).

1.04 SPECIFIC PROCEDURES

- A. Comply with requirements for startup of specific item as indicated in their respective sections of the specifications.

1.05 RECORDS

- A. Maintain records of startup activities in form of written reports. Report information shall include date, weather, personnel in attendance, procedures, results, and other pertinent information. Submit copies of written reports when requested.

1.06 STARTING SYSTEMS

- A. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

- B. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- C. Verify wiring and support components for equipment are complete and tested.
- D. Execute startup in accordance with manufacturers' instructions.

1.07 TESTING, ADJUSTING, AND BALANCING

- A. Employ, and pay for services of an independent firm to perform testing, adjusting and balancing.
- B. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.08 MANUFACTURER'S INSTRUCTIONS

- A. Provide manufacturers' printed instructions for startup and adjusting include description of equipment, method of operation and control including motors, pump units, signals, and special or non-standard features provided.
- B. Provide parts catalogs with complete list of equipment replacement parts with equipment description and identifying numbers.
- C. Provide schematic diagrams covering electrical equipment installed, including changes made in final work, with symbols listed corresponding to identity of markings on equipment.
- D. Compile information as required by provisions of Section 01700.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01700 CONTRACT CLOSEOUT

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Closeout Procedures.
- B. Adjusting.
- C. Operation and Maintenance Data.
- D. Warranties.
- E. Spare Parts and Maintenance Materials.
- F. Record Documents
- G. Instruction of Owner's Personnel.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 CLOSEOUT PROCEDURES

- A. Contractor shall submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's inspection. The completed Work shall be without any outstanding or concurrent Work remaining.
- B. Contractor shall prepare and submit to the Architect/Engineer a comprehensive list of items to be completed or corrected prior to Architect/Engineer's inspection.
- C. Provide to the Architect/Engineer two (2) copies of all submittals required by governing or other authorities, prior to final Application for Payment.
- D. Provide to the Architect/Engineer two (2) copies of all required certifications and occupancy approvals from local and state authorities having jurisdiction over the Work, prior to final Application for Payment. Receipt of all certificates and occupancy approvals in and of itself does not necessarily connote substantial completion.
- E. Provide to the Architect/Engineer three (3) copies of all certificates of testing and inspection as specified in the individual specification Sections and as required by the conditions of the Contract, prior to final Application for Payment.
- F. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- G. Before issuance of a final Application for Payment, the Contractor shall submit evidence satisfactory to the Architect/Engineer that all payrolls, material bills, and other indebtedness connected with the Work and for which the Contractor is responsible, have been paid.

H. Submit final waivers of lien.

1.04 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation, prior to final inspection.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit to the Architect/Engineer for review, two (2) copies of all required operation and maintenance manuals as specified in the individual specification Sections, prior to final inspection.

B. Submit sets bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.

C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project.

D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below with tab titling clearly printed under reinforced laminated plastic tabs.

E. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, type on 24-pound white paper.

F. Part 1: Directory, listing names, addresses, telephone and facsimile numbers, and contact persons of the Architect/Engineer, Contractor, Subcontractors, and suppliers.

G. Part 2: Operation and maintenance instructions arranged by system. For each category, identify names, addresses, telephone and facsimile numbers, and contact persons of the Subcontractors and suppliers. Identify the following:

1. Significant design criteria.

2. List of equipment.

3. Parts list for each component.

4. Operating instructions.

5. Maintenance instructions for equipment and systems.

6. Maintenance instructions for finishes including recommended cleaning methods and materials and special precautions identifying detrimental agents.

1.06 WARRANTIES

A. Provide two (2) notarized copies of all required warranties as specified in the individual specification Sections.

B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in binder with durable plastic cover.

D. Submit to Architect/Engineer for review and approval, prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

F. Architect shall forward warranties to Owner upon acceptance.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance, and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and obtain receipt, prior to final Application for Payment.

1.08 RECORD DOCUMENTS

A. Contractor shall insure that an accurate, on-going record is kept of all deviations from the approved design Drawings and Specifications, which may occur as actually constructed.

B. Upon completion of the Work, the Contractor shall submit to the Architect/Engineer for review, two (2) complete sets of the record ("as-built") drawings and specifications.

C. Contractor shall obtain receipt for the record documents and submit said receipt with request for final payment of the Contract. Final payment due the Contractor will be withheld until this clause has been fulfilled.

1.09 INSTRUCTION OF OWNER'S PERSONNEL

A. Before final inspection, schedule with Owner to instruct Owner's designated personnel in operation, adjustment and maintenance of products, equipment, and systems.

B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

PART2 PRODUCTS

Not used

PART3 EXECUTION

Not used

END OF SECTION

SECTION 01710 CLEANING

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Cleaning During Construction.
- B. Final Cleaning.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 SCOPE

- A. Provide all cleaning necessary for the proper execution and completion of the Work and as otherwise required by the Contract Documents.

1.04 CLEANING DURING CONSTRUCTION

- A. The job site must at all times be kept clean of all obstructions so as to provide easy access for execution of the Work, inspection and observation. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Clean affected areas of the job site after removal of waste materials or rubbish.
- D. Clean portions of the Work as necessary between installation of different materials and trades.
- E. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- F. Remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.05 FINAL CLEANING

- A. When all construction is complete (or before final inspection and the Owner takes occupancy under Substantial Completion), the area of the Work shall be professionally cleaned and presented to the Owner for acceptance. Cleaning shall include all items; interior, exterior exposed and concealed.
- B. All cleaning shall be in accordance with products manufacturer's recommendations.
- C. The Contractor is responsible for expediting the cleaning, washing, waxing and polishing required within the technical sections of the specifications.
- D. Remove all foreign matter, spots, oil, and construction dust so as to put the Project in a complete and finished condition ready for acceptance and use intended.

- E. Clean interior and exterior glass and surfaces exposed to view, remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- F. Clean equipment and fixtures to a sanitary condition.
- G. Clean filters of operating equipment.
- H. Clean debris from roofs, gutters, downspouts, and drainage systems.
- I. Clean site, sweep paved areas, rake clean landscaped surfaces.
- J. Remove waste and surplus materials, rubbish, and construction facilities from site.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

**SECTION 01720
PROJECT RECORD DOCUMENTS**

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Contract Documents.
- B. Daily Log.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 CONTRACT DOCUMENTS

- A. Provide a new set of Contract Documents at the job site to be used only for the development of project record documents for the Owner. Record changes, dimensions for field located items, and other pertinent information required to show the Work in the condition it was completed. Information shall be neatly drawn and noted with red pencil or ink at the time which that part of the Work is being done.

1.04 DAILYLOG

- A. The Contractor shall keep a daily log and provide a copy for the Owner and Architect at the job site each day. Log information shall include the date, weather conditions, time of day for start and finish of work, each trade and number of people working, description of work done that day, and other pertinent information to record the daily activities.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

Not Used

END OF SECTION

SECTION 01740 WARRANTIES

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Correction of Warranted Work.
- B. General Project Warranty.
- C. Specific Product Warranty.
- D. Manufacturer's Standard Product Warranty.
- E. Countersigned Warranty.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 CORRECTION OF WARRANTED WORK

- A. Replace or repair items that are defective or have failed under the terms of a warranty. Work shall be restored to the intended original condition.
- B. When correcting warranted Work, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

1.04 GENERAL PROJECT WARRANTY

- A. The Work, as a whole, is subject to warranty by the Contractor. All items shall be warranted for the full duration of time legally available to the Owner, in addition to any other warranties.

1.05 SPECIFIC PRODUCT WARRANTY

- A. Specific product warranty items are in addition to the general project warranty from the Contractor and give specific warranty requirements for selected products throughout the specification sections.
- B. Specific product warranties are from the Contractor and do not required submittal of a warranty form to be valid because they are a requirement of the Contract Documents and are validated by the execution (signature) of the Contract Documents/Agreement Form.

1.06 MANUFACTURER'S STANDARD PRODUCT WARRANTY

- A. Manufacturer's standard product warranties are preprinted written warranties published by individual manufacturers for particular products. Many products come with manufacturer's standard product warranties, whether specified as such or not. It is the responsibility of the Contractor to pass along to the Owner all such warranties for the Owner's acceptance or refusal. These warranty submittals shall be submitted through the Architect along with other contract closeout submittals.

1.07 COUNTERSIGNED WARRANTY

- A. Countersigned warranties are warranties that require the signature of parties other than, or in addition to, the Contractor (such as a subcontractor, installer, supplier, manufacturer, etc.), and are therefore warrantable directly from the other parties to the Owner.
- B. Countersigned warranties require the submittal of a properly executed (signed) warranty form from the warrantor directly to the Owner.
- C. Countersigned warranties are incorporated into the project when requested by the Owner (presumably upon advise of their legal, insurance, or other counsel) and included the following warranty items: none.

PART2 PRODUCTS

Not Used

PARTJ EXECUTION

Not Used

END OF SECTION

SECTION 02070 SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Remove designated building equipment and fixtures. Cap and identify utilities.
- B. Remove designated building elements and building elements not designated as required for new work.
- C. Removal of existing finishes and preparation for new materials.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 COORDINATION

- A. Conduct demolition to minimize interference with adjacent building areas. Maintain protected egress and access at all times.
- B. Provide, erect, and maintain temporary barriers and security devices.
- C. Coordinate extent of demolition with requirements of new construction.
- D. The demolition drawings are intended to indicate the bounds of work required. It is not expected that every item will be specifically called out in the documents. Contractor shall provide all demolition required for new construction regardless if shown on drawings or not.

PART2 PRODUCTS

Not Used

PART3 EXECUTION

3.01 EXAMINATION

- A. Examine area of work and drawings to gain a full understanding for the extent of work.
- B. Determine the extent and limits of items to be removed including but not limited to wall, ceiling, and floor materials and finishes; doors, windows, hardware and frames; plumbing, electrical, and mechanical items and accessories; furnishings and equipment.
- C. Coordinate all removal required to facilitate new construction.

3.02 PREPARATION

- A. Erect and maintain weatherproof closures for exterior openings.

- B. Protect existing items that are not scheduled for removal.
- C. Disconnect, remove, and cap affected utility services within demolition areas as required for work and in accordance with applicable codes.
- D. Mark location of disconnected utilities. Identify and indicate capping locations on Project Record Documents.

3.03 GENERAL DEMOLITION

- A. Demolish in an orderly and careful manner. Protect existing structural members, interior partitions and exterior architectural elements. Utilize saw-cutting, torch-cutting, dismantle, and similar techniques as appropriate for new construction.
- B. Except for items indicated for reuse, remove demolished materials from site as work progresses. Do not burn or bury materials on site.
- C. Remove materials to be re-installed or retained in manner to prevent damage. Store materials and protect materials against damage from construction activities or exposure to weather.
- D. Remove and promptly dispose of contaminated, vermin infested, or dangerous materials encountered. Remove and dispose of materials in accordance with applicable environmental codes and requirements.
- E. Upon completion of demolition work, leave areas of work in clean condition, ready for new construction.

3.04 WALL, FLOOR, AND FRAME REMOVAL

- A. Remove masonry walls and frames where indicated in a manner to allow new jambs, and partitions to be toothed into existing wall.
- B. Remove masonry above new wall openings as required to provide new lintels.
- C. Full height wall demolition and wall demolition indicated for new door openings shall be removed to or below floor line as required for new floor finish. Floor shall be level to within 1/8 inch in ten feet.
- D. Saw-cut floor slabs as required for installation of new footings and utilities.

3.05 CEILING REMOVAL

- A. Remove ceilings as required for new construction and in areas indicated on demolition plan.
- B. Remove panels, suspended grid, trim, and hangers. Clean adjoining wall surfaces of fasteners that will affect final finish appearance.
- C. Remove plaster, lath, suspension, and trim materials.
- D. Remove suspended panel ceilings for re-installation after above ceiling work is complete in locations shown or where otherwise required.

3.06 FINISH REMOVAL

- A. Remove existing finishes where indicated on drawings and where existing finish material will be detrimental to application of new finish materials.

END OF SECTION

SECTION 03001 CONCRETE GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. Concrete work shall conform to all requirements of the latest editions of the following; ACI 301, Specifications for Structural Concrete for Buildings, ACI 318, Building Code Requirements for Reinforced Concrete, and other related ACI publications, except as modified by the Supplemental requirements below.

1.02 SUPPLEMENTAL REQUIREMENTS

- A. Additional specifications requirements contained in ACI SP-15 shall apply as conditions or specifications require.
- B. The Sections following in Division 3 are considered to be supplementary to ACI 301 General Requirements.

1.03 REFERENCES

- A. ACI SP-15, Maintain one copy of document on site.

1.04 PROJECT RECORD DOCUMENTS

- A. Maintain and submit project record documents for concealed items cast in or passing through concrete walls and slabs and changes to or deviation from contract drawings under provisions of the General Requirements.

PART2 PRODUCTS

(Not Used)

PART3 EXECUTION

(Not Used)

END OF SECTION

SECTION 03300 CAST-IN-PLACE CONCRETE

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete slabs and toppings
- B. Concrete finishing
- C. Concrete sealer

1.02 COORDINATION

- A. Coordinate with mechanical for equipment pads, penetrations and sleeves, and anchor requirements.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Perform work in compliance with the recommendations of ACI 305R and ACI 306R.

PART2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Admixtures:
 - 1. Air Entrainment: ASTM C260.
 - 2. Chemical Admixture: ASTM C494, Type A - Water Reducing.
 - 3. Mineral Admixture: ASTM C618, Fly Ash and Raw or Calcined Natural Pozzolan.

2.02 CONCRETE MIX

- A. Mix and transport concrete in accordance with ACI 304R.
- B. Select proportions for normal weight concrete in accordance with ACI 301.
- C. Refer to structural drawings for concrete mix designs
- D. Concrete exposed to freeze-thaw cycles shall be air entrained with a minimum water to cement ratio of 0.45
- E. Concrete for interior slabs-on-grade shall have a water/cement ratio of 0.45 to 0.49

- F. Do not use calcium chloride unless approved by A/E. When allowed, add to concrete in solution with mixing water to achieve uniform disbursement.

2.03 CONCRETE ACCESSORIES

- A. Vapor barrier: Moistop Underslab Vapor Retarder, manufactured by Fortifiber Building Products Systems, (800) 773-4777
- B. Granular fill: Sand meeting requirements of MOOT Class II or ASTM D2487 SP of SW. Refer to geotechnical report for recommendations.
- C. Bonding agent: Sonobond, epoxy concrete bonding agent manufactured by Sonneborn ChemRex Inc., 889 Valley Park Drive, Shakopee, MN 55379

2.04 CONCRETE FINISHES

- A. Interior concrete floor sealer: Thoroshield as manufactured by Thora, Harris Specialty Chemicals, Inc., Jacksonville, FL, (800) 327-1570 or equal.

PART3 EXECUTION

3.01 PREPARATION

- A. Verify that sub-soil fill is complete, accurately placed and compacted to required density.
- B. Provide fill material compacted to 95% of soil's maximum density as determined by the Modified Proctor Method, under slabs 6 inches deep minimum unless note otherwise on drawings.
- C. Lay vapor barrier over compacted fill under floor slabs on grade. Lap vapor barrier minimum 6 inches and join seam continuously with tape. Seal vapor barrier to walls.

3.02 EXECUTION

- A. Perform work in accordance with ACI 301.
- B. Perform hot weather work in accordance with ACI 305R.
- C. Perform cold weather work in accordance with ACI 306R.
- D. Cure concrete using appropriate method and in accordance with recommendations of ACI 308. Curing compounds shall comply with ASTM C-309, coordinate with floor finishes.

3.03 SLABS

- A. Install construction joint devices in coordination with floor slab pattern.
- B. Place concrete continuously between predetermined expansion, control, and construction joints.

- C. Slabs on grade saw cut joints within 24 hours after concrete placement using 3/16 inch thick blade, cut into slab to 1/4 of its thickness. Install joints spaced not more than 15 feet on center in any direction unless indicated otherwise.
- D. Bonded topping over existing, roughened, concrete, and surrounding composite decking, shall not be saw cut. After cleaning, apply bonding agent to existing concrete just prior to placing new concrete.
- E. In areas containing floor drains, maintain floor elevation consistent at perimeter and slope floor slabs uniformly to floor drains to assure positive drainage, except where noted on drawings to form localized dishing of floor.
- F. In areas scheduled for ceramic or porcelain tile coordinate with tile contractor for slab recesses.

3.04 SLAB FINISHING AND TREATMENT

- A. Finish concrete using procedure as specified in ACI 301 11.7 and 11.8. Finish tolerances as specified in ACI 301 11.9.1 for Class A finish.
- B. Steel trowel finish slabs scheduled to receive carpeting, resilient flooring, thin set ceramic or porcelain tile, concrete floor sealer, or to remain unfinished.
- C. Cure all slabs for 7 days using a minimum 4 mil plastic, with taped joints, and sprayed to assure moisture retention.
- D. Apply concrete floor sealer to areas scheduled and as recommended by concrete floor sealer manufacturer.
- E. Immediately after placement protect slabs from traffic detrimental to finish work, sealer, topping, or floor finish adhesives.

3.05 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, elevations, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.
- D. Stained concrete shall be considered defective and shall be sand blasted clean. If sandblasting is ineffective concrete shall be replaced as required.

END OF SECTION

SECTION 06100 ROUGH CARPENTRY

PART1

1.01 SECTION INCLUDES

- A. Lumber
- B. Sheathing
- C. Wood Treatment

1.02 REFERENCES

- A. BOCA National Building Code/ 1996 Table 2305.2 Fastening Schedule.

PART2

2.01 MATERIALS

- A. Dimension Lumber: grade stamped by agency certified by the Board of Review of the American Lumber Standards Committee (ALS), kiln-dried to 19 percent moisture content, planed 4 sides, eased edges.
 - 1. douglas fir-larch; #2 structural light framing grade.
 - 2. hem-fir; #2 structural light framing grade.
 - 3. spruce-pine-fir; light framing standard grade.
- B. Sheathing: APA rated.
 - 1. Plywood: sheathing grade; span rating 32/16; exposure class type I; COX.
 - 2. Waferboard: sheathing grade; span rating 32/16; exposure class type I.
- C. Preservative Treated Lumber and plywood: AWPA C2-lumber and C9-plywood pressure treated; chromated copper arsenate (CCA) Type C; to the following minimum net retention of 0.25.
- D. Fire Retardant Treated Lumber: AWPA pressure treated lumber and plywood, using one of the following treatments:
 - 1. DRICON fire retardant wood treatment as manufactured by Hickson Corporation, 1100 Johnson Ferry Rd., Atlanta, GA 30342, (404) 843-3235.
 - 2. D-Blaze fire retardant wood treatment as manufactured by Chemical Specialties, Inc., One Woodlawn Green, Suite 250, Charlotte, North Carolina 28217, (704) 522-0825.
- E. Fasteners: Hot-dipped galvanized steel for exterior, high humidity, and treated wood locations; plain finish elsewhere; size and type to suit condition in accordance with BOCA Basic National Building Code 1996 Table 2305.2 Fastening Schedule.

- F. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolts or ballistic fasteners for anchorage to steel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate with work of other Sections for blocking and nailer requirements.
- B. Erect wood nailers and blocking and framing true to lines and levels.
- C. Construct members of continuous pieces of longest possible lengths.
- D. Provide fire-resistant wood for interior blocking and nailers.

END OF SECTION

SECTION 06400 ARCHITECTURAL WOODWORK

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Custom Casework

1.02 REFERENCES

- A. ADA Accessibility Guidelines for Buildings and Facilities.
- B. AWI Architectural Woodwork Quality Standards 400, Architectural Cabinets.
- C. AWI Architectural Woodwork Quality Standards 1600, Modular Casework.

PART 2 PRODUCTS

2.01 CUSTOM CASE WORK

A. Materials

1. Particleboard: ANSI A208.1 mat-formed particleboard, water resistant, minimum 45 lbs. per cubic foot density.
2. Plastic Laminate: NEMA general purpose grade
 - a. General purpose, horizontal: HGF, .050-inch
 - b. General purpose, vertical: VGF, .039-inch
 - c. Post forming, horizontal, formed radius edge: HGP, .039-inch
 - d. Backing sheet: BKL, .020-inch
 - e. Melamine panels: thermally-fused panels with thermoset melamine resin impregnated paper pressure bonded to both sides of industrial grade particleboard.
3. Edge banding: Plastic laminate matching exposed surface.
4. Counter top/ backsplash laminate to be Formica 3689-58 Himalayan Slate.
5. Closet shelves laminate to be Wilson Art - - 7039-60 Windsor Mahogany if applicable.

B. Cabinet construction.

1. Style: flush overlay, doors and fixed panels overlaying and concealing frames and sides of cabinet body.
2. Cabinets: AWI 1600 B, particleboard core, plastic laminate facing.
3. Joinery: biscuit and glued, dowel and glued, rabbet and glued, screw and glued.
4. Components:
 - a. Doors: 3/4-inch-thick melamine, plastic laminate exposed side
 - b. Drawer front: 3/4-inch-thick melamine, plastic laminate exposed side

- c. Panels: 3/4 inch thick melamine, plastic laminate exposed side
- d. Sides and stretchers: 3/4 inch thick white melamine
- e. Back panels: 1/2 inch thick white melamine
- f. Toe kicks: 3/4 inch thick particleboard
- g. Drawer box: 1/2 inch thick white melamine sides, ends, and bottom, doweled and glued, dadoed for bottom
- h. Edging: doors, drawer fronts, and cabinet case edged with plastic laminate
- i. Interior shelving: 3/4-inch thick white melamine.
- j. Exterior shelving: 3/4-inch particleboard, plastic laminate both sides

5. Cabinet Plastic Laminate Manufacturer/Color: Wilson Art - 7039-60 Windsor Mahogany.

2.02 CABINET HARDWARE

- A. Recessed pulls: WP-35 bright chrome as manufactured by EPCO Co., P.O. Box 108, Flint, MI 48501, (313) 767-2050.
- B. Wire pulls: MC-402-3 dull chrome as manufactured by EPCO Co., P.O. Box 108, Flint, MI 48501, (313) 767-2050.
- C. Hinges: 71.6500-175H7100 as manufactured by Julius Blum, Inc., Hwy. 16 Lowesville, Stanley, North Carolina 28164, (704) 827-1345.
- D. Shelf standard: #255, zinc finished steel as manufactured by Knappe & Vogt Mfg. Co., 2700 Oak Industrial Dr. S.E., Grand Rapids, MI 49505 (800) 253-1561.
- E. Shelf clip: #256, zinc finished steel as manufactured by Knappe & Vogt Mfg. Co., 2700 Oak Industrial Dr. S.E., Grand Rapids, MI 49505 (800) 253-1561.
- F. Locks: #987 NP as manufactured by Knappe & Vogt Mfg. Co., 2700 Oak Industrial Dr. S.E., Grand Rapids, MI 49505 (800) 253-1561.
- G. Coat rods: #KV-2 ZC as manufactured by Knappe & Vogt Mfg. Co., 2700 Oak Industrial Dr. S.E., Grand Rapids, MI 49505 (800) 253-1561.
- H. Threaded insert: wood screw exterior threads, 1/4" x 20 interior thread; steel.
- I. Knurled finger screw: 1 1/4" x 1/4" x 20; 9/16" diameter head; solid brass.
- J. Panel Brace: 50 1820 Chair Leg Brace 1" x 1" plain steel manufactured by Stanley Hardware, 480 Myrtle Street, New Britain, CT 06053, (800) 622-4393.

2.03 DRAWER HARDWARE

- A. Wire pulls: MC-402-3 dull chrome as manufactured by EPCO Co., P.O. Box 108, Flint, MI 48501, (313) 767-2050.
- B. Standard drawer slide: #1300, 75 lbs. rated as manufactured by Knappe & Vogt Mfg. Co., 2700 Oak Industrial Dr. E., Grand Rapids, MI 49505 (800) 253-1561
- C. File drawer slide: #1429, 100 lbs. rated as manufactured by Knappe & Vogt Mfg. Co., 2700 Oak Industrial Dr. E., Grand Rapids, MI 49505 (800) 253-1561.

2.04 COUNTER HARDWARE

- A. Joint fasteners: 513 ZC as manufactured by Knape & Vogt Mfg. Co., 2700 Oak Industrial Dr. E., Grand Rapids, MI 49505 (800) 253-1561
- B. Grommets: 2 3/4" diameter, black plastic grommet, slotted grommet cover with retractable/self-storing slot cover, 35BK as available from Outwater Plastic/Industries, 4 Passaic Street, Wood-Ridge, NJ 07075, 1-800-631-8375.
- C. Support bracket: Ultimate L-Bracket as manufactured by Knape & Vogt Mfg. Co., 2700 Oak Industrial Dr. E., Grand Rapids, MI 49505 (800) 253-1561.

2.05 ADJUSTABLE SHELVING

- A. Cantilever Shelving Hardware: 80 Standards and 180 Brackets color as selected by Architect. One bracket for each 12 inches of standard. Standards equally spaced not more than 36 inches on center. Standards lengths 6 feet for full wall adjustable shelves, 3 feet above counters or as shown on Drawings.
- B. Shelving: 3/4-inch-thick particleboard, softwood edge banding, enamel painted.

PART 3 EXECUTION

3.01 PREPARATION

- A. Field verify all dimensions prior to fabrication of custom cabinets or counters.
- B. Verify that mechanical and electrical rough in are in place and that work of surrounding area is ready to receive work of this Section.
- C. Coordinate with other trades for requirements of products to be installed in work of this Section.
- D. Protect adjacent work from damage by work of this Section.

3.02 INSTALLATION

- A. Shop and site fabricate components as required. Provide cutouts as required for products of other trades. Provide grommets for exposed cutouts.
- B. Install items as indicated on Drawings where hardware permits use concealed fastening method. Secure to walls with screws embedded one-inch minimum in solid wood framing or blocking.
- C. Provide shelves and coat rods for all closets, provide standards with adjustable brackets to allow rod and shelf to be installed with shelf at 48" minimum to 76" maximum.
- D. Install plumb and level with all joints tight.
- E. Shim work as required and trim with molding to match.
- F. Install items tight to walls, scribe units to wall as necessary.

G. Install miscellaneous hardware and accessories.

3.03 CLEANING AND ADJUSTMENT

A. Clean work and surrounding area of dirt and debris.

B. Remove packing materials.

C. Remove installation markings from all surfaces.

D. Adjust all doors, shelves and drawers to operate freely and align square and plumb with cabinets.

END OF SECTION

SECTION 08100 METAL DOORS AND METAL FRAMES

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Standard Steel Doors and Frames
- B. Interior Barrow Light Frames

1.02 RELATED SECTIONS

- A. Section 08200 Wood Doors
- B. Section 08700 Door Hardware
- C. Section 08800 Glass and Glazing

1.03 COORDINATION

- A. Coordinate with masonry contractor for installation of frames.
- B. Coordinate with wood door manufacturer, door hardware supplier and glazier.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated frames and doors. Provide doors that comply with requirements for labels as indicated on drawings.
- B. Label shall be affixed to jamb of door and frame indicating door rating.

1.05 SUBMITTALS

- A. Submit door and frame elevation and schedule shop drawings and product data.
- B. Submit door and frame shop drawings with shop drawings and product information for all glass and hardware products associated with doors and frames.

PART2 PRODUCTS

2.01 STEEL DOORS AND FRAMES

- A. Standard Steel Doors and Frames: comply with HMMA 861 - Specifications for Commercial Hollow Metal Doors and Frames, with door face and frame gages as modified in the door schedule.
- B. Interior Barrow Light Frames: comply with HMMA 861 - Specifications for Commercial Hollow Metal Doors and Frames, with door face and frame gages as modified in the door schedule.

2.02 STEEL DOOR AND FRAME FABRICATION

- A. Fabricate doors and frames as a welded unit. Fabricate doors and frames to style as indicated in drawings.
- B. Fabricate exterior doors with channel web out for flush closer top of door.
- C. Prepare frame for silencers. Provide three single rubber silencers for single doors on strike side, and two single silencers on frame head at double doors.
- D. Fabricate doors with 5/8" undercut standard or 3/8" for doors with thresholds.
- E. Fabricate frames with mortar boxes welded to frame at back of hardware cutouts to accommodate hardware installation.
- F. Provide junction boxes and conduit connecting boxes within frame, provide for conduit connections to boxes on frames as required for powered hardware.
- G. Attach fire rated label to each fire rated door and frame unit.
- H. Provide loose "T", welded strap or adjustable loop type anchors for masonry installations, welded metal strap for stud wall installation or thru bolt with tube spacer for existing wall installations.

2.03 STEEL DOOR AND FRAME FINISHES

- A. Interior Units: Shop primed coordinate primer with finish painting.
- B. Exterior Units: 0.60 oz/ sq ft galvanized prior to fabrication, shop prime.
- C. Finish: Field paint as specified in Section 09900 Painting.

PART3 EXECUTION

3.01 COORDINATION

- A. Section 08700 Hardware for installation requirements.
- B. Section 08800 Glass and Glazing for installation requirements.

3.02 PREPARATION

- A. Protect inside throat of each frame that will be grouted solid with a waterproof undercoating material minimum 1/8" thick.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and reviewed shop drawings
- B. Install in correct location, level, square and plumb, and in alignment with other work
- C. Provide three anchors minimum per jamb. Frames in masonry shall be filled with grout.
- D. All joints between frames and building structure shall be sealed in order to secure a watertight installation.

3.04 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust hardware for smooth and balanced door movement.

3.06 PROTECTION AND CLEANING

- A. Protect exposed portions of aluminum and painted surfaces from damage.
- B. Clean glass and frames prior to turning building over to Owner.

END OF SECTION

SECTION 08200 WOOD DOORS

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Wood Doors: Marshfield - Plain Sliced Red Oak - Cinnamon 36-95

1.02 RELATED SECTIONS

- A. Section 08100 Metal Doors and Frames
- B. Section 08700 Door Hardware
- C. Section 08800 Glass and Glazing

1.03 COORDINATION

- A. Doors of this Section are scheduled in Section 08100 coordinate work with manufacture of frames and requirements of hardware.

1.04 SUBMITTALS

- A. Submit door elevation and schedule shop drawings and product data under provisions of Section General Requirements .
- B. Submit manufacturer sample of Marshfield - Plain Sliced Red Oak - Cinnamon 36-95.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Protect products under provisions of General Requirements.
- B. Protect doors with resilient packaging, sealed with heat shrunk plastic. Break seal on site to permit ventilation.

1.06 WARRANTY

- A. Provide five-year manufacturer's warranty under provisions of General Requirements.
- B. Warranty: Cover veneer against splitting or delaminating.

PART2 PRODUCTS

2.01 DOOR CONSTRUCTION (AWI QUALITY STANDARD)

- A. Door Core: Solid, AWI Section 1300, PC-7.
- B. Fire Rated Door Core: U.L. approved mineral core or other labeled material.
- C. Glazing stops: hardwood standard; U.L. approved metal for rated doors.

2.02 DOOR AND PANEL FACING

- A. Facing Quality: AWI custom grade.
- B. Door Veneer: Oak species wood, plain sliced, random match, running assembly for transparent finish. Marshfield - Plain Sliced Red Oak - Cinnamon 36-95

2.03 ADHESIVES

- A. Doors: AWI, ANSI/NWMA, Type II water resistant.

2.04 FABRICATION

- A. Fabricate non-rated doors in accordance with AWI Quality Standards ANSI/NWMA I.S.1 requirements.
- B. Fabricate fire rated doors in accordance with AWI Quality Standards ANSI/NWMA I.S.1 and to UL requirements. Attach fire rating label to door edge.
- C. Provide flush doors with 2-inch-thick edge strips of wood species to match face veneer.
- D. Manufacturer shall shop prep doors for all finish hardware. Provide solid hardwood lock and hardware block.

2.05 GLASS AND GLAZING

- A. Glass: full tempered or wire glass as scheduled.

2.06 FINISHES

- A. Factory finish in accordance with AWI 1500 System TR-6 catalyzed polyurethane; medium gloss rubbed effect.
- B. Stain color: Marshfield - Plain Sliced Red Oak - Cinnamon 36-95.

PART3 EXECUTION

3.01 COORDINATION

- A. Coordinate with work of Section 08700 Hardware for installation requirements.
- B. Coordinate with work of Section 08100 Metal Doors and Frames for frame requirements.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions.
- B. Machine cut relief for hinges and closers and coring for handsets and cylinders.
- C. Pilot drill screw and bolt holes. Use threaded through bolts for half surface hinges.
- D. Prepare doors to receive finish hardware in accordance with AWI ANSI/AWMA requirements.

E. Conform to AWI ANSI/AWMA requirements for fit tolerances.

F. Coordinate installation of glass and glazing.

3.03 INSTALLATION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING AND CLEANING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08700 DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Door Hardware

1.02 REFERENCES

- A. ADA Accessibility Guidelines for Buildings and Facilities

1.03 SUBMITTALS

- A. Submit hardware schedule shop drawings and product data under provisions of the General Requirements. Submit summary of changes resulting from meeting with Owner.
- B. Submit keying schedule for Architect records. Keying schedule will not be reviewed.
- C. Include product cut sheets, schedule of hardware indicating each door and hardware. Note any hardware conflicts, provide recommendations.

1.04 PROJECT RECORD DOCUMENTS

- A. Maintain and submit project record documents for lock keying under provisions of the General Requirements.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data for door hardware under provisions of the General Requirements.

1.06 COORDINATION

- A. Builder's hardware items are scheduled for standard hollow metal, wood and aluminum doors. Coordinate with Contractors and suppliers for items scheduled but not supplied by others. Supply all products not provided by others.
- B. Verify hinges and closer are sized appropriately for door size and weight with hardware manufacturer. Provide appropriate product, notify Architect of adjustments.
- C. Verify products are appropriate for exiting requirements prior to ordering. Provide fail safe products along path of egress. Coordinate with control and alarm systems for control of doors along path of egress.
- D. Verify with Owner that hardware style, finish and operation is acceptable.
- E. Hardware supplier shall meet with Owner and Construction Manager to establish keying and to verify lock function, explain available lock functions and those selected for doors. Provide keying and functions as determined by this meeting. Submit summary of changes with hardware schedule for incorporation into review.

PART2 PRODUCTS

2.01 DOOR HARDWARE

A. Scheduled Hardware Manufacturers:

1. Closers: provide closers sized for door from series scheduled
 - a. LCN Closers, Div. Ingersoll-Rand, 121 W Railroad Ave, Princeton, IL 61356, (815) 875-3311
 - b. Stanley Hardware, 480 Myrtle Street, New Britain, CT 06053, (800) 337-4393
2. Electric strikes:
 - a. Von Duprin, Div. Ingersoll-Rand, 2720 Tobey Drive, Indianapolis, IN 46219, (317) 897-9944
 - b. Security Door Controls, P.O. Box 6219, Westlake Village, California 91359-6219, (800) 413-8783
3. Hinges:
 - a. McKinney Products Co., Essex Industries, 820 Davis St., Scranton, PA 18505, (717) 346-7551
 - b. Stanley Hardware, 480 Myrtle Street, New Britain, CT 06053, (800) 337-4393
4. Kickplates: Rockwood Mfg. Co., P.O. Box 79, Rockwood, PA 15557, (814) 926-2026
5. Locks:
 - a. Newport style trim with wrought rose or escutcheon, 626 finish, Sargent, no substitutions: Furnish and install cylinders and cores.
6. Magnetic switches:
 - a. Von Duprin, Div. Ingersoll-Rand, 2720 Tobey Drive, Indianapolis, IN 46219, (317) 897-9944
 - b. Security Door Controls, P.O. Box 6219, Westlake Village, California 91359-6219, (800) 413-8783
7. Overhead stops:
 - a. Glynn-Johnson, Div. Ingersoll-Rand, 2720 Tobey Drive, Indianapolis, IN 46219, (317) 897-9944
 - b. Rockwood Mfg. Co., P.O. Box 79, Rockwood, PA 15557, (814) 926-2026
8. Pulls: Rockwood Mfg. Co., P.O. Box 79, Rockwood, PA 15557, (814) 926-2026.
9. Pushes: Rockwood Mfg. Co., P.O. Box 79, Rockwood, PA 15557, (814) 926-2026.
10. Saddles:
 - a. National Guard Products, Inc., 540 North Parkway, Memphis, TN 38105, (800) 647-7874
 - b. Durable Products Inc., P.O. Box 520, 2717 Bushmill Road, Frankfort, OH 45628, (800) 237-8549
11. Sweeps:
 - a. National Guard Products, Inc., 540 North Parkway, Memphis, TN 38105, (800) 647-7874
 - b. Durable Products Inc., P.O. Box 520, 2717 Bushmill Road, Frankfort, OH 45628, (800) 237-8549
12. Thresholds:
 - a. National Guard Products, Inc., 540 North Parkway, Memphis, TN 38105, (800) 647-7874

b. Durable Products Inc., P.O. Box 520, 2717 Bushmill Road, Frankfort, OH 45628, (800) 237-8549

13. Wall stops: Rockwood Mfg. Co., P.O. Box 79, Rockwood, PA 15557, (814) 926-2026.

14. Weatherseals: National Guard Products, Inc., 540 North Parkway, Memphis, TN 38105, (800) 647-7874.

B. Other Hardware Manufacturers:

1. Closers: Norton Door Controls

2. Electric Strikes: Folger Adams

3. Exit Devices: Corbin Russwin, Sargent Manufacturing

4. Hinges: Hager Companies

5. Locks: Schlage Lock Co., Sargent Manufacturing, Yale Security

6. Overhead stops: Rixon Specialty Products

PART3 EXECUTION

3.01 PREPARATION

A. Protect elements that surround the work of this Section from damage or disfigurement.

B. Furnish diagrams, templates, instructions, and directions for installation. Distribute to other trades items required to be installed by other trades.

3.02 EXAMINATION

A. Verify that doors are prepared and in place, and that preps are correctly sized and ready to receive work.

B. Verify field measurements are as shown on shop drawings.

C. Verify that required utilities are available, in proper locations, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.03 INSTALLATION

A. Do not install products which are observed to be defective.

B. Handle and install in accordance with manufacturer's instructions. For conditions where printed instructions are not available or do not apply consult with manufacturer's technical representative.

C. Mounting heights for hardware from finished floor shall comply with ADA.

D. Perform cutting, drilling, and fitting required for the installation complying with templates or detail drawings and project conditions.

END OF SECTION

SECTION 08800 GLASS AND GLAZING

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Glass
- B. Glazing Accessories

1.02 REFERENCES

- A. BOCA National Building Code 1993 Section 2405.0 Safety Glazing.

1.03 QUALITY ASSURANCE

- A. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual Glazing Sealing Systems Manual for glazing installation methods.
- B. Label safety

1.04 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store and protect products under provisions of the General Requirements.

1.05 WARRANTY

- A. Provide five-year manufacturer's warranty under provisions of the General Requirements.
- B. Warranty: Include coverage of sealed glass units from seal failure, inner pane dusting or misting, and replacement of same.

PART2 PRODUCTS

2.01 GLASS

- A. Glass: Annealed; float glass; 1/4-inch-thick minimum.

2.02 GLAZING ACCESSORIES

- A. Spacer: Aluminum with welded or soldered corners and desiccant fill. Finish of exposed edge to match aluminum frames.
- B. Primary Seal: Butyl tape or mastic, unvolcanized; 10 - 15 shore A hardness.
- C. Secondary Seal: Silicone; 40 - 50 shore A hardness.
- D. Setting Blocks: Neoprene, EDPM, or silicone; Shore A hardness of 85 + 5, sized 0.1-inch length per square foot of glass area (4 inches minimum), 1/16 inch narrower than channel

width, height to provide recommended nominal bite and minimum edge clearance, two identical blocks per glass unit,

- E. Anti-walk Spacer Blocks: Neoprene, EDPM, or silicone; 40-60 Shore A durometer hardness; 6-inch minimum length, 1/4 inch thick, width equal to unit thickness.

PART3 EXECUTION

3.01 INSPECTION

- A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.
- B. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses.
- C. Prime surfaces scheduled to receive sealant.

3.03 GLAZING

- A. Locate setting blocks at quarter points with their nearest edge no closer than 6 inches to the corner of the unit.
- B. Locate anti-walk spacers at mid-point of both jambs.

3.04 CLEANING

- A. After installation, mark pane with an "X" by using plastic tape or removable paste.
- B. Remove labels after work is completed.

END OF SECTION

SECTION 09250 GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Framing.
- B. Gypsum board and sheathing
- C. Accessories

1.02 REFERENCES

- A. Gypsum Association GA-214, Levels of Gypsum Board Finish
- B. Gypsum Association GA-216-89, Application and Finishing of Gypsum Board
- C. Underwriters Laboratories Fire Resistance Directory, 1995.

PART2 PRODUCTS

2.01 FRAMING

- A. Standard metal studs: C profile; with runners of same material; unless otherwise indicated gages based on size, spacing and height as follows:

size and spacing	maximum height per size and gage		
	25 gage	22 gage	20 gage
3 5/8" at 16" on center	16'-0"	17'-3"	18'-3"
3 5/8" at 24" on center	13'-6"	15'-0"	16'-0"
6" at 16" on center	20'-0"	25'-3"	26'-6"
6" at 24" on center	15'-0"	22'-0"	23'-3"

Studs for wall to receive ceramic tile finish shall be 3 5/8", 20 gage minimum at 16" on center maximum.

- B. Furring channels: 1 5/8 inches hat sections 25 gage metal
- C. Fasteners: Self-drilling, self-tapping, bugle head screws.
- D. Anchorage Devices: Power driven, drilled expansion bolts or screws with sleeves.

2.02 CEILING/BULKHEAD FRAMING

- A. Select from the following systems:
 - 1. Conventional framing system
 - a. Cross Furring: 3/4 inch rolled channel; 0.30 lb/ft.
 - b. Main Runners: 1 1/2 inches hot rolled channel; 1.12 lb/ft.

- c. Hangers: 8 gage galvanized wire.
 - d. Galvanizing: ASTM A526 G60, minimum.
2. Suspended T framing system: Drywall furring system by Armstrong Ceilings, Suspension System & Acoustical Walls, (888) 234-5464

2.03 GYPSUM BOARDS

- A. Regular gypsum board: ASTM C36; 5/8-inch thick, square cut ends, tapered edges
- B. Water Resistant Gypsum Board: ASTM C630; 5/8 inch thick, ends square cut, square edges.

2.04 ACCESSORIES

- A. Corner bead: ASTM C1047; preformed metal angle.
- B. Expansion joint: ASTM C1047; preformed metal 'V' with flanges.
- C. Vapor barrier: 6 mil, polyethylene sheet
- D. Sound batt insulation: ASTM C665 Type I, 4 inches thick, unfaced fiberglass.

PART3 EXECUTION

3.01 COORDINATION

- A. Coordinate with other work for installation of blocking and anchors
- B. Coordinate with electrical and mechanical work for installation of bucks, anchors, and blocking to be placed in or behind stud framing.

3.02 EXAMINATION

- A. Verify that conditions are ready to receive work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that rough-in utilities are properly located.
- D. Beginning of installation means installer accepts existing conditions.

3.03 CEILING AND SOFFIT FRAMING

- A. Select from framing system options install suspended T system as recommended by manufacturer for anticipated loads. Install conventional system as listed below.
- B. Install hangers at 4 feet on center maximum both directions. Coordinate placement of hangers with structure and mechanical above.
- C. Install main runners parallel to line of building equally spaced at 4 feet on center maximum. Use galvanized material at areas of high humidity.
- D. Install cross runners perpendicular to main runners spaced at 16 inches on center. Use galvanized material at areas of high humidity.

- E. Install perimeter J-bead at all locations where ceilings abut walls maintain tight joint. Install control joints at not more than 30 feet on center both directions.

3.04 ERECTION STUD WALLS

- A. Align top and bottom runners, secure runners at 24 inches o.c.
- B. Fit runners under and above openings; secure intermediate studs at spacing of wall studs
- C. Install studs vertically
- D. Connect studs to tracks with fasteners
- E. Stud splicing permissible. Limit to 10 percent of studs and 30 percent or more of length. Splice studs with 8-inch nested lap, secure each stud flange with flush head screw
- F. Construct corners using minimum three studs
- G. Double studs at wall openings, door and window jambs, and not more than 2 inches each side of openings
- H. Brace stud framing system and make rigid
- I. Coordinate erection of studs with requirements of door and window frame supports and attachments
- J. Align stud web openings
- K. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and other built-in items
- L. Install sound batt insulation in all stud partitions

3.05 FURRING INSTALLATION

- A. Align and secure furring to wall tight to adjacent surfaces.
- B. Install furring at 24 inches on centers. Coordinate installation of insulation at exterior walls. Install insulation tight to web of Z furring on both sides.
- C. Construct corners using minimum two members.
- D. Install furring on exterior wall to full height and to 12" above ceiling at interior walls.

3.06 CEILING FRAMING INSTALLATION

- A. Install hangers at 4 feet on center maximum both directions. Coordinate placement of hangers with structure and mechanical above.
- B. Install main runners parallel to line of building equally spaced at 4 feet on center maximum. Use galvanized material at areas of high humidity.
- C. Install cross runners perpendicular to main runners spaced at 16 inches on center. Use galvanized material at areas of high humidity.

- D. Install perimeter J-bead at all location where ceilings abut walls maintain tight joint. Install control joints at not more than 30 feet on center both directions.

3.07 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with manufacturer's instructions and GA - 216-89.
- B. Erect gypsum board perpendicular to framing with ends and edges occurring over firm bearing.
- C. All partitions shall extent full height from floor to underside of deck. Install sound batt insulation within all wall cavities and gypsum board sheathing full height of the wall.
- D. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board joint that will remain exposed abuts dissimilar materials.
- E. Install FiberBond in accordance with current Fiber8ond Wallboard Guide to installation number 6-5-A/S
- F. Install tile backer board to 12" above ceiling height on partition in shower rooms.

3.08 JOINT TREATMENT

- A. Standard finish level of gypsum board shall be GA-214 level 4.
- B. Finish level of gypsum board above ceiling hidden to view shall be GA-214 level 1.
- C. Tape and as instructed by manufacturer.

END OF SECTION

SECTION 09300 TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor Tile
- B. Base Tile
- C. Setting Materials
- D. Grouting Materials
- E. Accessories

1.02 REFERENCES

- A. Tile Council of America, Handbook for Ceramic Tile Installation

1.03 SUBMITTALS

- A. Submit information as indicated.
- B. Indicate various materials, styles where applicable and sub-contractor.
- C. Submit samples of tile and transition strip specified.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of the General Requirements.

1.05 COORDINATION

- A. Coordinate with work of Section 03300 for floor slab recesses and requirements prior to placement of slabs.
- B. Color and style shall be specified by Architect. Submit sample for final approval in advance of material order. Assume 10 % percent of tile area will be of an accent color for bidding.

PART 2 PRODUCTS

2.01 FLOOR TILE

- A. Porcelain paver tile manufactured by Crossville Ceramics Co., P.O. Box 1168 Industry Pkwy, Crossville, TN 38555, (615) 484-8418
 - 1. Field Floor Tile: Cross Colors, A750 Brown Tweed, unpolished, 12 x 12 inches.
 - 2. Accent Floor Tile: Cross Colors, A880 Onyx, unpolished, 12 x 2 inches.

2.02 BASE TILE

- A. Porcelain base tile manufactured by Crossville Ceramics Co., P.O. Box 1168 Industry Pkwy, Crossville, TN 38555, (615) 484-8418.

- 1. Base Tile: Cross Colors, A750 Brown Tweed, unpolished, 4 x 8 inches bullnose, outside corners.

2.03 SETTING MATERIALS

- A. Epoxy mortar, A118.3
- B. Latex-Portland Cement mortar, ANSI A108.5 and A118.4

2.04 GROUTING MATERIALS

- A. Polymer Modified Tile Grout (sanded and unsanded): ANSI A108.10, A118.6 and A118.7, color as specified manufactured by TEC, color 915 Light Smoke.

2.05 ACCESSORIES

- A. Movement joints and transitions strips: Anodized aluminum color as selected by Architect.

PART3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Coordinate installation method as required for existing and new substrate materials.
- C. Beginning of installation means installer accepts condition of existing substrate.

3.02 PREPARATION

- A. Protect surrounding work from damage or disfigurement.
- B. Vacuum clean existing substrate and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Apply conditioner to surfaces as recommended by adhesive manufacturer.

3.03 INSTALLATION - GENERAL

- A. Request tile pattern from Interior Design Consultant. Do not interrupt tile pattern through openings.
- B. Cut and fit tile tight to penetrations through tile. Form corners neatly.
- C. Cut floor tile that would bridge construction or control joints in concrete slabs at the joint continuing pattern either side of joints.

- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Sound tile after setting. Replace hollow sounding units.
- F. Allow tile to set for a minimum of 48 hours prior to grouting.
- G. Grout tile joints.

3.04 INSTALLATION - FLOOR FINISH

- A. Standard Installation: Latex-Portland Cement Mortar and Grout - TCA Handbook for Ceramic Tile Installation, 2002 Handbook Number F113-02.
- B. Maintain grout joint equal in spacing.
- C. Provide movement joint at floor slab control joints, provide transition strip where floor tile terminates along a horizontal surface.

3.05 CLEANING

- A. Clean work under provisions of the General Requirements.
- B. Clean tile surfaces.

3.06 PROTECTION

- A. Protect finished installation.
- B. Do not permit traffic over finished floor surface.

END OF SECTION

SECTION 09500 ACOUSTICAL TREATMENT

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustical Ceiling Systems

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F and humidity of 20 to 40 percent prior to, during, and after installation.

1.03 SEQUENCING/SCHEDULING

- A. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Schedule installation of acoustic units after interior wet work is dry.

PART2 PRODUCTS

ACOUSTICAL CEILING SYSTEMS

- A. Ceiling Panels: manufactured by Armstrong Architectural Building Products, (800) 448-1405.
 - 1. AC-1: Suspended Acoustical - Match Existing - No Substitutions.
 - a. Panels: No 538 2x2 Cirrus Tegular fine texture, beveled tegular, 9/16" grid face.
 - b. Suspension system: Suprafirie 9/16 inch pre-finished Tees and pre-finished wall angles, white color, design appropriate for panel, wire hangers.
 - 2. Accessories: retention clips, designed for suspension system.

PART3 EXECUTION

3.01 INSTALLATION ACOUSTICAL CEILING

- A. Verify that existing conditions are ready to receive work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Measure each room to determine best layout. Direct questions regarding layout to Architect. Verify layout with mechanical requirements. Doubling of tee members shall not be permitted.
- D. Install system in accordance with manufacturer's instructions.
- E. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

- F. Install after major above ceiling work is complete and has been tested. Coordinate the location of hangers with other work.
- G. Hang system independent of ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- I. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
- J. Do not eccentrically load system or produce rotation of runners.
- K. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions. Field rabbet tile panel edge. Where bullnose concrete block corners round obstructions occur, provide preformed closers to match edge molding.
- L. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- M. Lay directional patterned units one way with pattern parallel to shortest room axis. Fit border neatly against abutting surfaces.
- N. Install acoustic units level, in uniform plane, and free from twist, warp and dents.
- O. Provide retention clips at inmate accessible areas for ceilings at or below 10 feet above floor directly below. Provide clips to hold each panels at four points.

3.02 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Replace wall plates and accessories removed prior to work of this Section.

3.03 TOLERANCES

- A. Variation from Flat and Level Surface: 1/8 inch in 10 ft non-cumulative
- B. Variation from Plumb of Grid Members Caused by Eccentric Loads: Two degrees maximum.

END OF SECTION

SECTION 09680 CARPET

PART1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet Carpet
- B. Backing
- C. Base
- D. Accessories

1.02 QUALITY ASSURANCE

- A. All sheet carpeting supplied to Job shall be from the same manufacturer

1.03 SUBMITTALS

- A. Submit information.
- B. Submit samples of carpet specified for final approval.
- C. Submit seaming drawing for approval by Architect.
- D. Submit carpet fire rating certificate.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of the General Conditions.

1.05 COORDINATION

- A. Color and style specified by the Architect will be reviewed for final approval.

PART2 PRODUCTS

2.01 SHEET CARPET

- A. Shaw Contract Group, 380 S. Industrial Blvd., Calhoun, GA 30701, (800) 257-7429
 - 1. Style: Shimmer Ultra Loe, Color: 17500 Chocolate Silk.

2.02 BACKING

- A. Provide sheet carpet with minimum 10-year Back Warranty, Tuft bind, Edge Ravel, Delamination, Static and Wear. Shaw Contract Group - Ultra Loe backing.

2.03 BASE

A. Carpet Base:

1. CPTB: same material as adjacent floor carpet, 4 inches, bound exposed edges.

2.04 ACCESSORIES

- A. Moldings: vinyl; reducers, aluminum transitions at floor paver tile, and edge guards.
- B. Adhesives: as recommended by manufacturer.
- C. Floor leveler: Thoro Trowel Grade Underlayment with Thoro Primer 800.

PART3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surface is smooth and flat with maximum variation of 1/8 inch in 10 ft and is ready to receive work.
- B. Verify concrete floors are dry to maximum moisture content of 7 percent; and exhibit negative alkalinity, carbonization, or dusting.
- C. Examine carpet; notify Architect of any variation in color within or between rolls.
- D. Beginning of installation means acceptance of substrate and site conditions.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to leave smooth, flat, and hard surface.
- C. Prohibit traffic until filler is cured.
- D. Vacuum floor surface.

3.03 INSTALLATION

- A. Apply carpet and adhesive in accordance with manufacturers' instructions.
- B. Lay out rolls of carpet.
- C. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed. Edge seam carpet at public areas.
- D. Locate seams in area of least traffic.
- E. Fit seams straight, not crowded or peaked, free of gaps.
- F. Lay carpet on floors with run of pile in same direction as anticipated traffic.

- G. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.
- H. Cut and fit carpet around interruptions.
- I. Fit carpet tight to intersection with vertical surfaces without gaps.

3.04 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09900 PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Paint, Primer, Sealers for Interior Applications
- B. Wood Finishing

1.02 COORDINATION

- A. All shop primed metal items (door, door and window frames, metal fabrications, manufactured items) shall be field painted, verify which materials are pre-finished and which are shop primed. Coordinate finishing.
- B. Refer to schedules and drawings for painting materials notes.
- C. Submit samples of specified paint color for final approval.
- D. Assume that all hollow metal frames will be an accent color.

1.03 REGULATORY REQUIREMENTS

- A. All products used shall VOC compliant.

1.04 SUBMITTALS

- A. Submit information indicated.
- B. Indicate various materials, styles where applicable and sub-contractor.
- C. Submit samples from specified colors for final approval.
- D. Submit paint schedule, provide manufacturer's product data for all materials to be used and list building areas and proposed paint materials.

1.05 PROJECT RECORD DOCUMENTS

- A. Maintain and submit project record documents for paint bases and tinting used throughout project under provisions of the General Requirements.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit cleaning and maintenance data under provisions of the General Requirements.

PART2 PRODUCTS

2.01 PAINTS, PRIMERS, SEALERS AND FILLERS

A. Manufacturer

1. PPG Industries, Inc., Architectural Finishes Group, PPG Industries, One PPG Place - 38 East, Pittsburgh, PA 15222, (800) 441-9695.

B. Interior Paint:

1. P-1: (gypsum, cement, masonry, wood): Latex Egg shell enamel, high solid, vinyl acrylic; (metal): Latex semi-gloss enamel, high solid.

Wall and bulkhead color: Pittsburg Paints 414-3 Toasted Almond.

Accent wall color to be determined if applicable.

2. EP-1 (gypsum, cement, masonry, metal): Water-based catalyzed epoxy, low-odor/no-shutdown, sanitary coating.

Metal door frames: Pittsburg Paints 521-7 Star Anise.

2.02 PAINT SYSTEMS

- A. All paint materials shall be appropriate for substrate and topcoat material.
- B. Painting shall be done in one primer coat (primer/sealer for gypsum board, primer/filler for concrete, concrete plank and concrete block) and two finish coats.
- C. Painting of walls shall be as follows:
 1. Exposed structure or suspended acoustical ceiling - prime full height, finish to exposed height, prime and paint prior to ceiling installation.
 2. Hard ceilings - prime and paint exposed wall.
- D. All materials shall be applied to wet/dry film thickness using methods recommended by manufacturer for substrate and materials used for moderate to severe wear conditions.
- E. Interior finish materials shall conform to ASTM E84 Class I.

2.03 WOOD FINISH

- A. Transparent Stain: Oil based transparent stain, color to be selected.
- B. Finish: Catalyzed Polyurethane. Submit samples indicating sheen (flat, semi-gloss, gloss) for selection by Architect.

PART3 EXECUTION

3.01 INSPECTION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content meets the recommendations of the manufacturer.

- D. Beginning of installation means acceptance of existing surfaces.

3.02 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect work of this Section.
- C. Verify with security sealant manufacturer that paint is suitably compatible with security sealant. Where paint may interfere with adhesion of security sealant mask joints neatly prior to painting.
- D. Shellac and seal marks which may bleed through surface finishes.
- E. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Stucco - surface must be clean and dry, temperature must be 50 For above, pitch streaks shall be scrapped, sanded, and spot primed before full priming.
- G. Concrete Block - surface must be free of dirt, loose or excess mortar and thoroughly dry. Allow new block construction to dry 30 days minimum before painting.
- H. Poured Concrete - surface must be cleaned of all grease, dirt, oil, laitance, efflorescence and loose mortar and cement. Maximum moisture content shall be 15%. Allow newly poured concrete to cure 30-60 days before painting. Temperature of Air concrete and materials must be maintained above 55 F for 24 hours before, during, and after painting.
- I. Aluminum - surface must be cleaned of all oil, grease, dirt, and oxide by wiping, etching, scrubbing, steam cleaning, or solvent cleaning.
- J. Galvanized Metal - surface should be weathered a minimum of 6 months then solvent or blast cleaned of all dirt, oils, and mill scale.
- K. Misc. Iron/Steel - surface must be cleaned of all oil, grease, mill scale, dirt, foreign matter, rust using solvent or blast methods.
- L. Wood (Exterior) - surface must be clean and dry to maximum 12% moisture content. No painting shall be done immediately after rain, during fog, or when temperature is below 50 F.
- M. Wood (Interior) - all surfaces shall be sanded smooth with the grain. Surface blemishes shall be corrected. The room shall be cleaned of dust. Lightly sand between coats.
- N. Gypsum Board - surface must be clean, dry, and free of dust.

3.03 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfigurement.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or dropping from disfiguring other surfaces.

- D. Remove empty paint containers from site.

3.04 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply one primer coat and two finish coats.
- D. Apply each coat to uniform finish.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.
- G. Where clear finishes are required, tint fillers to match stained wood. Apply filler prior to finish coat.
- H. Prime back surfaces of interior and exterior woodwork with primer paint.
- I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- J. After security sealant is installed return to cut in finish paint to edge of sealant where materials remain exposed.

3.05 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint unfinished equipment.
- B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are pre-finished.
- D. Replace identification markings on mechanical or electrical equipment if painted over.
- E. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- F. Paint exposed conduit and electrical equipment occurring in finished areas.
- G. Paint exposed fire sprinkler lines located in finished areas. Verify locations with A/E
- H. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
- I. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

3.06 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B.** Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- C. During progress of Work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

END OF SECTION

SECTION 10520 FIRE EXTINGUISHERS AND CABINETS

PART1 GENERAL

1.01 WORK INCLUDED

- A. Fire extinguishers.

1.02 RELATED WORK

- A. All parts of the Contract Documents relate to the Work specified in this section.

1.03 SUBMITTALS

- A. Submit product data under provisions of Section 01340.
- B. Include physical dimensions, operational features, color and finish.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01700.
- B. Include test, refill or recharge schedules, procedures, and re-certification requirements, including requirements applicable to the Work.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperatures may cause freezing.

1.06 COORDINATION

- A. Coordinate cabinet mounting style for construction of wall at cabinet location.

PART2 PRODUCTS

2.01 EXTINGUISHERS

- A. Multi-purpose 2A-10BC, 5 lb. canister fire extinguishers, select from the following manufacturers:
 1. 3005 - Potter-Roemer fire Protection Div., 16833 Edwards Road, Cerritos, CA 90701, (310) 404-3753
 2. Larsen's Manufacturing Company, 7421 Commerce Lane N.E., Minneapolis, MN 55432, (612) 571-1181
 3. J.L. Industries, 4450 W. 78th Street Circle, Bloomington, MN 55435, (612) 835-6850

2.02 FIRE EXTINGUISHER BRACKETS

- A. Wall mounting bracket with retaining straps, select from the following:

1. 3901 - Potter-Roemer, Fire Protection Div., 16833 Edwards Road, Cerritos, CA 90701, (310) 404-3753
2. J.L. Industries, 4450 W. 78th Street Circle, Bloomington, MN 55435, (612) 835-6850.
3. Larsen's Manufacturing Company, 7421 Commerce Lane N.E., Minneapolis, MN 55432, (612) 571-1181.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify size, number, type and location of fire extinguishers with fire official.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Secure rigidly in place, in accordance with manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.00 WORK PROPOSAL

THIS SPECIFICATION IS MENT TO IDENTIFY GENERAL DESIGN OF THESE SYSTEMS ONLY. The Sprinkler contractor shall coordinate directly with both the 15 and 16 trades to complete a fully operable system.

1.01 REFERENCE STANDARDS

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2010.
- C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.
- D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 2011.
- E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers; 2007.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- G. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2008.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.
- I. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2010 (ANSI/AWWA C105/A21.5).
- J. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.
- K. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2010.
- L. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- M. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.02 WORK INCLUDED

- A. This Section specifies automatic sprinkler systems for buildings and structures. Materials and equipment specified in this Section include:
 - Pipe, fittings, valves, and specialties.
 - Sprinklers and accessories.
- B. When structure configuration and code requires a dry system shall be installed for all or partial areas of the building. All items to produce a full and operating system shall be included.
 - C. Pumps

1.03 SUBMITTALS

- A. Product Data for each type of sprinkler, valve, piping specialty, fire protection specialty, fire department connection specified.
- B. Furnish scale drawings of entire system for submission to authorities having jurisdiction.
- C. Submit shop drawings and product data under provisions of Section 15000.
- D. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.

- E. Submit shop drawings and product data to authority having jurisdiction for approval. Submit proof of approval to Architect/Engineer.
- F. Indicate pump type, capacity, power requirements, affected adjacent construction.
- G. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- H. System to have some areas with Preaction requirements. These areas to be identified on design plans.

1.04 QUALITY ASSURANCE

A. Qualifications:

Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer.

B. Regulatory Requirements:

Comply with the requirements of the following codes:

NFPA 13 - Standard for the Installation of Sprinkler Systems.

UL Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled.

C. Provide pumps with manufacturer's name, model number, and rating/capacity.

D. Test pump, driver, and controller in accordance with NFPA 20.

E. Approvals:

1. Obtain permits and approvals from the authority having jurisdiction, as required.
2. Contractor shall provide hydraulic design criteria, density information and sprinkler installation/documentation, and obtain approval from the State Fire Marshall's office in accordance with Act 07 and as amended by Act 144.
3. **Equipment and Components:** Bear UL Label or marking.
4. **Equipment and Components:** Bear stamp of approval of authority having jurisdiction.

PART 2 PRODUCTS

2.01 PIPE

A. Steel Pipe:

ASTM A 120, Schedule 40, seamless, black steel pipe, plain ends.

B. Steel Pipe:

ASTM A 120, Schedule 10, seamless, black steel pipe, plain ends.

C. CPVC Pipe:

CPVC Sprinkler pipe to conform to the requirements of ASTM F443 and carries the markings of Underwriters Laboratories Inc. (UL & C-UL), and Factory Mutual (FM). Vertical pipe and pipe within fire rated areas to be steel.

D. Grooved Piping: Steel Pipe: ASTM A 120, Schedule 10 black steel pipe with grooved ends. All grooves must meet manufacturer's specifications.

2.02 FITTINGS

A. Cast-Iron Threaded Fittings:

ANSI B16.4, Class 250, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.

B. Cast-Iron Threaded Flanges:

ANSI B16.1, Class 250, raised ground face, bolt holes spot faced.

C. CPVC Fittings:

CPVC sprinkler fittings to conform to the requirements of ASTM F438, ASTM F439, and ASTM F1970. Fittings to carry the markings of Underwriters Laboratories Inc. (UL & C-UL), and Factory Mutual (FM). Female threaded adapters for sprinkler head connections shall contain brass inserts.

D. Couplings & Fittings for Grooved Piping System

1. Ductile Iron Grooved End Fittings & Couplings: All products must be of one domestic manufacturer. All products must be manufactured of ASTM A 536 ductile iron. Approved manufacturers: Victaulic FireLock.
2. Plain End Pipe: Victaulic Pressfit & FIT system are approved for all 2" and smaller piping in lieu of threading.

2.03 VALVES

A. Gate Valves - 2 Inches and Smaller:

Body and bonnet of cast bronze, 175 pound cold water working pressure - non-shock, threaded ends, solid wedge, outside screw and yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open.

B. Double Check Valve Assembly:

Bronze body construction, replaceable seats, ball valve test cocks, Watts Series 709 or approved equal.

C. Valves for Grooved Piping System

1. Grooved Butterfly Valves: Ductile iron body, UL, Victaulic 708's or engineer approved equal.
2. Grooved Check Valves: Ductile iron body, UL, Victaulic 717 or engineer approved equal.

2.04 ACCEPTABLE MANUFACTURERS - SPRINKLER HEADS

- A. GEM, VIKING, or substitutions under provisions of Section 15000.

2.05 AUTOMATIC SPRINKLERS

A. Sprinkler Heads (SHALL BE RECESSED / CONCEALED, EXCEPT IN GARAGE&LEVEL 1:

1. Fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2 inch discharge orifice, for "Ordinary" temperature range.
2. Upright or Pendent Type: GEM F-950.
3. Recessed Type: GEM F-947.
4. All sprinklers to be chrome or natural brass finish, 165 degrees F rating.

B. Sprinkler Head Finishes:

Provide heads with the following finishes:

Upright, Pendent, and Sidewall Styles:

Chrome plated in finish spaces, exposed to view;
Rough bronze finish for sprinklers in unfinished spaces

2.06 FIRE PUMP CONSTRUCTION

- A. Statically and dynamically balance rotating parts.
- B. Construction to permit complete servicing without breaking pipe or motor connections.
- C. Pumps to operate at 1,750 rev/min.

D. Fire Pumps: Vertical in-line type; UL 448 and UL 778; single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 150 psig or 1.25 times actual working discharge pressure.

- 1 Casing: Cast or ductile iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- 2 Impeller: Bronze, fully enclosed, keyed directly to motor shaft.
- 3 Shaft: Solid alloy steel with bronze sleeve.
- 4 Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

E. Fire Pump Accessories:

1. Eccentric suction reducer and OS&Y gate or butterfly valve on suction side of pump.
2. Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.
3. Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.
4. Main relief valve, UL 1478, and enclosed type waste cone.
5. Suction pressure gage, 4-1/2 inch diameter dial with snubber, valve cock and lever handle.
6. Discharge pressure gage mounted on board attached to pump, with snubber, valve cock and lever handle.
7. 3/4 inch casing relief valve.
8. Float operated 3/4 inch automatic air release valve.
9. Hose valve manifold with 2-1/2 inch hose gate valves with caps and chains.
10. Flow metering system for closed loop testing

2.07 ACCEPTABLE MANUFACTURERS - HORIZONTAL CENTRIFUGAL PUMPS

- A. Patterson
- B. Substitutions: Under provisions of Section 15000.

2.09 FIRE PUMP ACCESSORIES

- A. Check valve in discharge pipe.
- B. OS&Y gate or butterfly valves on system side of check valve and on supply side of pump.
- C. Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.
- D. Pressure gages, suction and discharge.
- E. Circulation relief valve.
- F. Umbrella cock, automatic air release.
- G. Splash shield between pump and motor.
- H. Manifold with hose gate valves.

2.10 FIRE PUMP ASSEMBLY CONTROLS

- A. Controller: Hands-off automatic switch, fire water pressure switch to operate pump drive, fire water pressure switches for alarms.
- B. Local alarms with indicating lights for low fire water pressure and high fire water pressure.
- C. Contacts for remote circuits to indicate pump operational status and alarm status.

2.11 ACCEPTABLE MANUFACTURERS - PRESSURE BOOSTER (JOCKEY) PUMP

- A. Patterson
- B. Grundfos
- C. Substitutions: Under provisions of Section 15000.

2.12 PRESSURE BOOSTER (JOCKEY) PUMP

- A. Electrically operated pressure booster pump to maintain pressure.
- B. Provide shut-off valves, check valve, and relief valves.

2.13 DRY SYSTEM COMPONENTS

A. Equipment:

Materials and equipment as required include:

- Air Compressor
- Dry valve
- Air Maintenance device
- Accelerator
- Pressure switch
- Monitoring of control valves.

2.14 FIRE PUMP TEST CONNECTIONS

- A. Equal to Croker 6815 series. Flush type Less valve or Freestanding Pipe with Valve. Type as per directed by ARCHITECT.

2.15 STANDPIPE

- A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; most current.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.
- C. Hose Connection Valve: Angle type; brass finish; 2-1/2 inch size, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish; refer to Section 21 0500.
- D. Drain: 3/4 inch automatic drip, outside.
- E. Label: "Standpipe - Fire Department Connection".
- F. Standpipe to be prepared for painting.
- G. Provide valve and hose connection at each elevation as required per code.

2.16 FIRE DEPARTMENT CONNECTION

- A. Type: Free standing type with ductile iron pedestal chrome plated finish. . Hose Connection Valve (TWO WAY CLAPPER INLET): Equal to Croker 6010-6042 series. Finish as per directed by ARCHITECT.
- B. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish. , 300 psi working pressure.
- C. Drain: 3/4 inch automatic drip, outside.
- D. Label: "Standpipe - Fire Department Connection".

PART 3 EXECUTION

3.01 PIPING INSTALLATIONS

- A. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.
- B. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- C. Install unions in pipes 2 inches and smaller, adjacent to each valve.
- D. Install Piping to accommodate 10ft-0in ceilings.
- E. Hangers and Supports:
Comply with the requirements of NFPA 13.

- J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Do not penetrate building structural members unless indicated.
- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- N. Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.02 VALVE INSTALLATIONS

A. General:

Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13, and the authority having jurisdiction.

3.03 SPRINKLER INSTALLATIONS

- A. Provide automatic sprinklers of type indicated on Drawings, and in accordance with the following listing. Provide fusible links for 165 degrees F (74 degrees celsius) unless otherwise indicated.
 - 1. Upright, in areas without lay in ceiling.
 - 2. Pendent, in lay in ceilings.
- B. Install Spare Sprinkler Cabinet:
Install cabinet containing spare sprinkler heads and appropriate wrench (es) per NFPA 13.
- C. Sprinkler heads to be centered in ceiling spaces.

3.04 INSTALLATION - PUMP

- A. Pipe drain from pump bases, pump stuffing boxes, and pump casings to floor sinks or drains.
- B. Provide air vent valves on pump cases.
- C. Use long radius elbows on suction side of pump.
- D. Do not support piping from pump casing.
- E. Align base mounted pumps.
- F. Install in accordance with NFPA 20.
- G. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.
- H. Install piping in accordance with Section 15.050. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.
- I. Provide drains for bases and seals, piped to and discharging into floor drains.
- J. Provide for connection to electrical service. Refer to Section 16000.
- K. Lubricate pumps before start-up.
- L. Check, align, and certify pumps by qualified installer prior to start-up.
- M. Sprinkler pump to be connected to sprinkler system.

3.05 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.
- B. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

3.06 SYSTEM TESTS

- A. Hydrostatically test entire system.
- B. Test shall be witnessed by authority having jurisdiction.
- C. The dry system portion shall be fully drained and pressurized with compressed air.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Pipe and pipe fittings.
- B. Valves.
- C. Sanitary sewer piping system.
- D. Domestic water piping system.
- E. Natural gas piping system.

1.02 RELATED WORK

- A. Architectural - Earth Work.
- B. Section 230700 - Piping Insulation.
- C. Section 224010 - Plumbing Specialties.

1.03 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with [ANSI/ASME Sec 9.] [ANSI/AWS D1.1.]

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 230000.

PART 2 - PRODUCTS

2.01 SANITARY SEWER AND STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D3033 or D3034, SDR 35. Fittings: PVC. Joints: ASTM F477, elastomeric gaskets.

2.02 SANITARY SEWER AND STORM WATER PIPING, BURIED AND ABOVE GRADE, BUT CONCEALED WITHIN BUILDING

- A. PVC Pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld.
NOTE: Concealed is defined as a pipe that is contained within a wall or in a fire rated chase.

2.03 SANITARY SEWER AND STORM WATER PIPING, ABOVE GRADE (In Exposed Areas)

- A. **Provide an Alternate only.** PVC Pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld. If used in exposed areas, piping must be covered with minimum 1" fiberglass insulation with approved fire resistance rating. **NOTE:** Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling.
- B. Cast iron pipes (**in exposed areas & on vertical installations**): ASTM A74; C1SP1 301.
NOTE: Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling.

2.04 WATER PIPING, BURIED

- A. Copper Tubing: ASTM B75 or B88 or B251, Type K, annealed temper. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME B16.29, wrought copper. Joints: 95.5% tin, 4% copper, .5% silver "lead free" solder.

2.05 WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B75 or B88 or B251, Type L, hard drawn. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME B16.29, wrought copper. Joints: 95.5% tin, 4% copper, .5% silver "lead free" solder.

2.06 NATURAL GAS PIPING ,BURIED BEYOND 5 FEET OF BUILDING

- A. Gas Company to install and furnish material to bring gas service to building.

2.07 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53 or A120, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe two inches and under; ANSI/AWS D1.1, welded, for pipe over two inches, welded in concealed locations for all sizes.
- B. Test Criteria: Gas piping shall be tested with air or an inert gas. System to be tested to a pressure of 1-1/2 times the system working pressure, but not less than 3 psi. Piping system shall maintain the full-test pressure for a period of 10 minutes.
- C. Piping in concealed locations shall not have unions, fittings, or threads.

2.08 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16 inch thick preformed neoprene bonded to asbestos.
- C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.09 GATE VALVES

- A. Up to 2 Inches: Bronze body, rising stem and handwheel, inside screw, double wedge or disc, solder.
- B. Over 2 Inches: Iron body, bronze trim, rising stem and handwheel, OS&Y, double wedge, flanged ends.

2.10 GLOBE VALVES

- A. Up to 2 Inches: Bronze body, rising stem and handwheel, inside screw, renewable composition disc, solder screwed ends, with backseating capacity.
- B. Over 2 Inches: Iron body, bronze trim, rising stem and handwheel, OS&Y, plug-type disc, flanged ends.

2.11 BALL VALVES

- A. Up to 2 Inches: Bronze body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
- B. Over 2 Inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle.

2.12 GAS COCKS

- A. Up to 2 Inches: Bronze body, bronze tapered plug non-lubricated, Teflon packing, threaded ends.
- B. Over 2 Inches: Cast iron body and plug, non-lubricated, Teflon packing, flanged ends.

2.13 SWING CHECK VALVES

- A. Up to 2 Inches: Bronze 45 degree swing disc, screwed ends.
- B. Over 2 Inches: Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

2.14 SPRING LOADED CHECK VALVES

- A. Iron body, bronze trim, spring loaded, renewable composition disc, screwed, wafer, or flanged ends.
- B. Over 2 Inches: Cast iron body, bronze fitted, elastomer diaphragm and seat disc, flanged.

2.15 ACCEPTABLE MANUFACTURERS

- A. Nibbco, Red and White, Grinnell, and Substitutions: Under provisions of Section 230000.

2.16 ACCEPTABLE MANUFACTURERS - RELIEF VALVES

- A. Watts.
- B. Substitutions: Under provisions of Section 230000.

2.17 RELIEF VALVES

- A. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside.
- C. Prepare piping connections to equipment with unions.

3.02 INSTALLATION

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Provide access where valves and fittings are not exposed. {Coordinate size and location of access doors with Section 230000.
- C. Slope water piping and arrange to drain at low points.
- D. Establish elevations of buried piping outside the building to ensure not less than minimum cover by code.
- E. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- F. Prepare pipe, fittings, supports, and accessories not finished, ready for finish painting. Refer to Section 230000.
- G. Establish invert elevations, slopes for drainage to 1/8 inch per foot one percent minimum. Maintain gradients.
- H. Install bell and spigot pipe with bell end upstream.
- I. Install valves with stems upright or horizontal, not inverted.

3.03 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install globe valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of water pumps.

3.04 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601.
- I. Results shall be written up in a report and submitted to both the General trades contractor and Engineer. Results to also be submitted to health department if/as required by code.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Water heaters.
- B. Pumps.

1.02 RELATED WORK

- A. Section 230000 - Mechanical General Provisions
- B. Section 230500 - Basic Mechanical Materials and Methods
- C. Section 230529 - Supports and Anchors.
- D. Section 230548 - Vibration Isolation.

1.03 REFERENCES

- A. ANSI/ASME Section 8D - Pressure Vessels.
- B. ANSI/NFPA 30 Flammable and Combustible Liquids Code.
- C. ANSI/NFPA 70 - National Electrical Code.

1.04 QUALITY ASSURANCE

- A. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- B. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
 - 1. American Gas Association (AGA).
 - 2. National Sanitation Foundation (NSF).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. National Electrical Manufacturers' Association (NEMA.)
 - 5. Underwriters Laboratories (UL).
- C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.05 REGULATORY REQUIREMENTS

- A. Conform to AGA, NSF, NBBPVI, ANSI/NFPA 54, ANSI/NFPA 58, ANSI/NFPA 70, UL 174, ANSI/UL 1453 requirements for water heaters.
- B. Conform to ANSI/ASME Section 8D, ANSI/NFPA 30, ANSI/NFPA 31 for tanks.

1.06 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 230000.
- B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
- C. Indicate pump type, capacity, power requirements and affected adjacent construction.
- D. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- E. Submit manufacturer's installation instructions under provisions of Section 230000.
- F. Submit manufacturer's certificate under provisions of Section 230000 that pumps meet or exceed specified requirements.

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- E. Submit manufacturer's installation instructions under provisions of Section 230000.
- F. Submit manufacturer's certificate under provisions of Section 230000 that pumps meet or exceed specified requirements.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 230000.
- B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 230000.
- B. Store and protect products under provisions of Section 230000.
- C. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

- A. Provide five year manufacturer's non-prorated warranty under provisions of Section 230000.
- B. Warranty: Include coverage of domestic water heaters and in-line circulators.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - IN-LINE CIRCULATOR PUMPS

- A. Bell & Gossett
- B. Substitutions: Under provisions of Section 230000.

2.02 IN-LINE CIRCULATOR PUMPS

- A. Casing: Bronze, rated for 125 psig working pressure.
- B. Impeller: Bronze.
- C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- D. Seal: Carbon rotating against a stationary ceramic seat.

- E. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

- A. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, NFPA, UL requirements.
- B. Coordinate with plumbing piping and related gas venting and electrical work to achieve operating system.

3.02 PUMP INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide air cock and drain connection on horizontal pump casings.
- C. Provide line sized gate valve and strainer on suction and line sized soft seated check valve and globe valve on discharge.
- D. Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
- E. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Floor Drains.
- B. Cleanouts.
- C. Backflow Preventers.
- D. Water Hammer Arresters.
- E. Thermostatic Mixing Valves.
- F. Hose Bibs Hydrants.

1.02 RELATED WORK

- A. Section 230500 - Materials and Methods.
- B. Section 221116 - Plumbing Piping.

1.03 QUALITY ASSURANCE

- A. ANSI/ASSE 1012 - Backflow Preventers with immediate Atmospheric Vent.
- B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
- C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- D. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- E. ANSI A112.21.1 - Floor Drains.
- F. ANSI A112.26.1 - Water Hammer Arresters.
- G. PDI WH-201 Water Hammer Arresters.

1.04 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 230000.
- B. Include component sizes, rough-in requirements, service sizes, and finishes.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - FLOOR DRAINS

- A. Wade, Zurn, Jay R. Smith.
- B. Substitutions: Under provisions of Section 230000.

2.02 FLOOR DRAINS

- A. ANSI A112.21-1: Cast iron two piece body with double flange, weep holes, reversible clamping collar, and adjustable strainer; Model Z-415 manufactured by Zurn.

2.03 ACCEPTABLE MANUFACTURERS - CLEANOUTS

- A. Wade, Zurn, Jay R. Smith.
- B. Substitutions: Under provisions of Section 230000.

2.04 CLEANOUTS

- A. Interior Finished Floor Areas: Cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel-bronze strainer, round with scoriated cover in service areas. Model Z-1400 manufactured by Zurn.

2.05 ACCEPTABLE MANUFACTURERS - BACKFLOW PREVENTERS

- A. Chicago, Watts, Wilkins (Zurn).
- B. Substitutions: Under provisions of Section 230000.

2.06 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks; Series 909 manufactured by Watts.
- B. Double Check Valve Assemblies: ANSI/ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent; Series 709 manufactured by Watts.

2.07 WATER HAMMER ARRESTERS

- A. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 degrees F to +300 degrees F and maximum 250 psig working pressure.

2.08 ACCEPTABLE MANUFACTURERS - THERMOSTATIC MIXING VALVES

- A. Lawler, Leonard, Powersza.
- B. Substitutions: Under provisions of Section 230000.

2.09 THERMOSTATIC MIXING VALVES

- A. Provide thermostatic mixing valve, with check valve, volume control shut-off valve on outlet, stem type thermometer on outlet, strainer stop check on inlet.

2.10 ACCEPTABLE MANUFACTURERS - HOSE BIBS/HYDRANTS

- A. Woodford, Wade, Zurn.
- B. Substitutions: Under provisions of Section 230000.

2.11 HOSE BIBS/HYDRANTS

- A. Bronze or brass, replaceable hexagonal disc, hose thread spout, with vacuum breaker in conformance with ANSI/ASSE 1011. Woodford Model 65.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate forming of floor construction to receive drains to required invert elevations.

3.02 INSTALLATION AND APPLICATION

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Extend cleanouts to finished floor surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install water hammer arresters complete with accessible isolation valve.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This Division includes all labor, materials, equipment, tools, supervision, start-up services, Owner's Instructions, including all incidental and related items necessary to complete installation and successfully test and start up and operate in a practical and efficient manner the Mechanical Systems indicated on Drawings and described in each Section of Division 23 Specifications and conforming with all Contract Documents.
- B. Bidding: the Contractor shall bid the project in strict accordance with the plans and Specifications. Alternative methods or materials, beyond those indicated as "Base Bid", proposed by the Contractor shall be in the form of a voluntary alternate, with all details indicated, and a separate add or deduct price for these changes submitted with the Contractor's bid. (Reference General Requirements - Product Substitutions)
- C. Mechanical systems complete and in place, shall include the following:
- | | |
|-------------------|---|
| MECHANICAL: | |
| SECTION 230000 | MECHANICAL GENERAL PROVISIONS |
| SECTION 230500 | BASIC MECHANICAL MATERIALS AND METHODS |
| SECTION 230516 | EXPANSION COMPENSATION |
| SECTION 230523 | VALVES |
| SECTION 230529 | SUPPORTS AND ANCHORS |
| SECTION 230548 | VIBRATION ISOLATION |
| SECTION 230553 | MECHANICAL IDENTIFICATION |
| SECTION 230593 | TESTING, ADJUSTING AND BALANCING |
| SECTION 230594 | IAQ FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION |
| SECTION 230700 | THERMAL INSULATION |
| SECTION 232113 | HYDRONIC PIPING |
| SECTION 232500 | CHEMICAL (WATER) TREATMENT |
| SECTION 233100 | DUCTING |
| SECTION 234100 | AIR FILTERS |
| SECTION 235216 | PACKAGED BOILER |
| FIRE SUPPRESSION: | |
| SECTION 211300 | WET/DRY PIPE FIRE SUPPRESSION SYSTEM |
| PLUMBING: | |
| SECTION 221116 | PLUMBING PIPING |
| SECTION 224010 | PLUMBING SPECIALTIES |
| SECTION 224100 | PLUMBING FIXTURES |
| SECTION 223000 | PLUMBING EQUIPMENT |
- D. The General Provisions of this Contract, including General and Supplementary Conditions and other General requirements Sections, apply to the Work specified in this Section.
- E. This Section is not intended to supersede, but to clarify the definitions in Division 1, General Requirements and Supplementary Conditions.

F. Drawings and Specifications:

1. Drawings and Specifications are intended to complement each other, and all work specified and not shown or work shown and not specified shall be provided as though mentioned in both specifications and drawings.
- Minor items and accessories or devices reasonably inferable as necessary to the complete and proper operation of any system shall be provided by the Contractor or Subcontractor for such system, whether or not they are specifically called for by the specifications or drawings.
- Drawings are diagrammatic and indicate general arrangement of systems and work included in the Contract, and shall serve only as design drawings, to represent design intent for general layout of various equipment and systems and not intended to be scaled for rough-in measurements or to service as measured shop drawings.
- If directed by the Engineer, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work. (Refer to General Requirements for co-ordination between trades).

1.02 RELATED WORK

- Section 260000 - Electrical General Provisions
- Section 250000 - Direct Digital Controls
- All building construction documents.

1.03 COORDINATION OF WORK

A. Responsibility:

1. The Mechanical Contractor shall be responsible for his Sub-Contractors and Suppliers, and include in his bid all materials, labor, and equipment involved, and install in accordance with all local customs, codes, rules, regulations, jurisdictional awards, and decisions; and secure compliance of all parts of the Specifications and Drawings regardless of Sectional inclusion in these Specifications.
2. The Mechanical Contractor and Sub-Contractor shall be responsible for all tasks applicable to their trades as directed by the General Contractor, in accordance with the Specifications, Drawings, and code requirements, and shall be responsible for coordinating locations and arrangements of their work to give best results with all other relevant Mechanical, Architectural, Structural and Electrical Contractors' Specifications, Drawings and shop drawings. Coordinate work so that sprinkler heads, lights, diffusers, etc. are coordinated into Project and are installed per the architectural reflected ceiling plan.

B. Site and Project Document Examination:

1. Submission of a proposal is considered evidence that the Contractor has visited site and acquainted themselves with all existing conditions, made all necessary measurements, examined the Drawings and Specifications of all trades, including Mechanical, Architectural, Structural, and Electrical, and has fully informed himself with all Project and site conditions, and is proficient, experienced and knowledgeable of all standards, codes, ordinances, permits and regulations which affect the installation of his respective trade, and that all costs are included in his proposal.
2. No allowance shall subsequently be made in his behalf for extra expense incurred due to failure or neglect on his part to make this visit and examination.
3. The Mechanical Contractor and/or Sub-Contractor shall obtain all required permits and assessments have been obtained prior to starting work. Contractor shall verify requirement to include privilege fees and permits as part of his formal bid, as described in General and Supplementary Conditions.
4. It is the responsibility of the Contractor to notify the Engineer, prior to submitting his bid, of any potential problems that he has identified during his site visit or from examination of the Contract documents.

C. General Supports:

1. Provide all necessary angle and channel brackets or supplementary steel as required for adequate support for all piping, specialties, and equipment which is hung or mounted above floor. No trade shall hang equipment from work of another trade (such as sprinkler lines hanging from heating lines or electrical conduit). Secure approval from Architect, in writing, before welding or bolting to steel framing or anchoring to concrete structure.
2. Where piping or equipment is suspended from concrete construction, set approved concrete inserts in formwork to receive hanger rods, such as Unistrut or Powerstrut, and where installed in metal deck, use Ramset or Welds as required.

D. Access Panels:

1. No valve, trap, control, fire damper, duct access opening, etc., shall be installed in inaccessible locations without access panels. Any subcontractor having items requiring access shall also include access panels for same unless Drawings indicate otherwise. Contractor shall be responsible for quantities of panels and receive approval for locations of panels from Architect/Engineer before installation.
2. Any wall, ceiling, or floor access panels required shall be equal to Milcor with hinged door and latch. Those in walls or floor shall be type to accept finished surface material. Those in ceiling shall be exposed metal.
3. Removable ceilings or sections of ceilings are acceptable as access panels. Panels in rated construction shall have U.L. label and proper rating and construction to match partition, ceiling, or roof assemblies in which they occur.
4. Purchase proper access panel, coordinate location, have General Contractor install access panel, and reimburse for installation. This trade is to coordinate the access panel manufacturer with the architectural access panels.

E. Field Changes:

1. This Contractor shall not make any field changes which affect timing, costs, or performance without written approval

from the Architect/Engineer in the form of a Change Order, Field Change Order, or a Supplemental Instruction. In special circumstances, verbal approvals pending paperwork may be acceptable. The Contractor assumes liability for any additional costs for changes made without such instruction or approval. Should any unauthorized change be determined by the Architect/Engineer as lessening the value of the project, a credit will be determined and issued as a change to the contract in accordance with the General Requirements.

1.04 STANDARDS, CODE AND PERMITS

- A. Refer to General Requirements and Supplementary Conditions.
- B. All work installed under Mechanical Sections shall comply with latest edition of applicable standards and codes of following:

ADAG	Americans with Disability Act Guidelines, Title III
ASA	American Standards Association
ASME	American Society of Mechanical Engineers
SMACNA	Sheet Metal & Air Conditioning Contractor Association
NSF	National Sanitation Foundation
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society of Testing Materials
ANSI	American National Standards Institute
AGA	American Gas Association
AWWA	American Water Works Association
NFPA	National Fire Protection Association
IBR	Institute of Boiler and Radiator Manufacturers
AWS	American Welding Society
UL	Underwriter's Laboratories
NEMA	National Electric Manufacturers Association
NESC	National Electric Safety Code (H13)
ARI	American Refrigeration Association
OSHA	Occupational Safety and Health Act
ABMA	American Boiler Manufacturers Association
BOCA	Mechanical and Plumbing Code as Amended by State of Michigan
CAGI	Compressed Air and Gas Institute

- C. All work shall be provided and tested in accordance with all applicable local, county, and state laws, ordinances, codes, rules, and regulations.
- D. Contractor shall give all notices, file all drawings, obtain necessary approvals, obtain all permits, pay all fees, deposits, and expenses required for installation of all work under this Contract.
- E. No work shall be covered or enclosed until work is tested in accordance with applicable codes and regulations, and successful tests witnessed and approved by authorized inspection authority. Written approvals shall be secured by Contractor and kept on file for inspection by the Engineer.
- F. In general, all material, where applicable, shall be labeled or listed by Underwriters' Laboratories, Inc.
- G. In the event that plans and specifications conflict with any rules, regulations, or codes applying, said rules, regulations, and codes shall govern the Contractor.
- H. Michigan Mechanical Code latest required version.

1.05 SUBMITTALS

A. Shop Drawings:

1. After a schedule of Sub-Contractors is approved by the Engineer, submit six (6) neatly bound copies of shop drawings (or number as directed by General Requirements) with one device or fixture of each type clearly identified (high-lighted, bolded, underlined, etc.) in each set on equipment and materials indicated on drawings or in the specifications.
2. Submit complete manufacturer's shop drawings of all equipment, plumbing fixtures, accessories, and controls, including dimensions, weights, capacities, construction details, installation, control methods, wiring diagrams, motor data, etc.
3. Engineer's approval of shop drawings is for general application only, and is a service that is not considered as a guarantee of total compliance with, or that relieves the Contractor of basic responsibilities under all Contract Documents, and does not approve changes in time or cost.

4. After approval, each Contractor is responsible for expeditiously providing information to all other trades involved in, or affected by, installation of his equipment and work.

B. Operating and Maintenance Instructions and Manuals:

1. Each Contractor shall provide for all major items of equipment two (2) copies, in 3-ring notebooks, of indexed sets of operating and maintenance instructions to Engineer for approval. After approval, manuals will be given to Owner by Engineer.
2. Manuals shall include a complete set of shop drawings submitted, repair parts lists, manufacturer's standard equipment manuals, valve tag schedule, and automatic control diagrams, all indexed with tabs for each section.
 - a. Operating Instructions:
Typewritten instructions regarding the starting and operating of all equipment and accessories. Operating instructions shall be encased in plastic and mounted in mechanical room. Provide additional copies of above materials in 3-ring notebooks. Operating instructions within notebooks shall also include locations of temperature control devices, switches, and equipment (including air handlers, pumps, etc.). Also, include steps of trouble-shooting and describe areas served by equipment.
 - b. Maintenance Instructions:
Provide a list of all mechanical contractors and subcontractors, including contact person and day/night telephone numbers. Upon completion of work, provide for periods not less than four (4) hours, competent person to instruct Owner in operation and maintenance of mechanical systems, equipment, controls, etc.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Standards:

1. All products shall be provided by established manufacturers regularly engaged in making the type of materials to be provided and shall be complete with all parts, accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

B. Substitution and Changes:

1. Contractor and/or Equipment Supplier may propose alternate equipment or materials of equal quality, function, durability, and appearance as described and permitted in Specification Section 15000, 1.01.B. The substitution will take the form of an "Add-Deduct" at the time of bid submittal. It is the submitter's responsibility to provide sufficient material for review as may be required by the Engineer's office. Acceptance and approval is the responsibility of the Engineer.
2. No substitutions will be accepted, except as authorized in a Project Addendum.
3. Contractor and/or Equipment Supplier is liable for any added costs to himself or others, and is responsible for verifying dimensions, clearance, and roughing-in requirements, when product not specifically named or described as the basis of design is used. The Contractor is responsible for advising other Contractors of variations and, if requested, submitting revised drawing layout for approval of the Engineer.

C. Explanation of Scheduled Manufacturers:

1. **Base Bid.** This term designates that this equipment will be the product which the contractor generates his bid from. It is usually a component that is critical to maintaining the design intent. No other equipment suppliers will be allowed to bid as an equal.
2. **Based On.** This term designates that the equipment is designed around a certain product. Products of equal status are listed and may be bid as if they were the basis of design. The **based on** equipment shall serve as the standard to which equals will be judged.

2.02 ELECTRICAL REQUIREMENTS

A. Motor Starters and Controls:

1. Electrical Contractor shall provide all manual or magnetic motor starters as required for motors as indicated on the Electrical Drawings and specified in Division 16.

2. Mechanical Contractor shall provide factory installed motor starters and/or safety switches, integral with packaged equipment, containing thermal over current protection in ungrounded conductors with heater coils selected for specific motor usage for motors.
3. "Package equipment" shall be defined as Mechanical, Architectural, Civil, or other Trade's equipment, and which is specified in other divisions of this specification, and which shall be furnished and installed complete with all associated electrical components by those trades.

Other Trades providing package equipment shall also provide both integral and remotely located devices if necessary for a complete system, ready for operation except for a single incoming power source. These devices may include main disconnect switches, heavy duty disconnect switches, starters, control transformers, interlocks, relays, fuses, terminal blocks, capacitors, wire, wire and device identification, conduit, and other necessary components.

Any special work to be provided under this division of the specifications outside the definition of package equipment shall be as noted on the drawings accompanying these specifications, or as specially noted after the package equipment list entry hereinafter.

B. Electrical Wiring and Controls:

1. Mechanical Contractor shall provide all motors, drives, and controllers integral to packaged equipment and factory mounted controls for all mechanical equipment. When pre-wired equipment is used, control circuit shall be separately fused at control transformer, and shall always revert to a fail-safe condition.
2. Mechanical Contractor shall provide electrical devices requiring mechanical/electrical connections, such as pressure switches, limit switches, float switches, solenoid valves, motor operated valves, etc.
3. Electrical Contractor shall install power wiring and conduit to motors and/or factory mounted control panels as indicated on Drawings or in specifications.
4. All electrical wiring work by Mechanical Contractor shall be in accordance with Division 16 requirements.

PART 3 - EXECUTION

3.01 CONNECTIONS AND SERVICES

A. Connections to Existing Lines Within Building:

1. Where existing lines are indicated on Drawings, connection shall be on an "as found" basis. Include all necessary costs to make proper connection.
2. Locate, identify, maintain, and protect existing mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

B. Connecting Into Existing Facility and Street Lines:

1. Connection into existing service and street lines shall be on an "as found" basis. All service interruption shall be coordinated with Owner and public utility. No interruption of utilities shall be made without prior arrangement with Owner.
 2. Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.

C. Continuity of Services:

Continuity of all existing utility services in building shall be maintained throughout construction period. Where new services are to be tied into existing services, it shall be done when and as directed by Owner, General Contractor, or Engineer.

3.02 CLOSEOUT

A. Final Acceptance:

Final acceptance and payment will only be made after the final check list completion and receipt at Engineer's office of:

- All Guarantees/Warranties
- Test Reports
- Operating and Maintenance Instruction Manuals (2)
- Record Drawings (As-Built)

Certificates of Inspection
Lubrication and Valve Charts
Maintenance Contracts, if required
Spare Parts (i.e. filters, etc.)
Test and Balance Reports - Air and Hydronic
Boiler Start-up Report

B. Certificates of Inspection and Test Reports:

The Contractor is to provide the Engineer with evidence that the installation has been inspected and approved by municipal or state inspector having jurisdiction over that phase of work involved, i.e., plumbing, heating, boiler, fire protection, refrigeration, etc.

C. Guarantees and Warranties:

1. During the one year guarantee period (except if General Requirements specify a longer warranty period), make two complete inspections (at approximately 3 months and 10 months) of all systems, fixtures, equipment, safety devices, and controls to ensure that the equipment is operating properly, and report to the Engineer in writing. The visits are to be coordinated with the owner.

D. Record Drawings:

1. Maintain a white-print set of Mechanical Contract Drawings in clean, undamaged condition for mark-up of actual installation on Contract Drawings, which vary substantially (i.e. location of piping, ductwork, size changes, etc.) from the work as shown.

E. Operating and Maintenance Instructions:

1. Provide instruction of Owner's personnel in operation and maintenance procedures for all systems equipment such as boilers, HVAC equipment, temperature controls, etc.
2. Provide the Owner with instructions on the location of hand valves, and other concealed items, etc.

F. Placing Systems into Operation:

1. Mechanical Contractor shall be responsible for all start-up procedures, system checks and balancing, and coordinating work of other Contractors and Sub-Contractors to assure cooperation.
2. All equipment shall be installed, tested and operated in accordance with the manufacturer's recommendations at normal operating conditions.
3. Permanent equipment may be operated during construction only with adequate protection from damage and dirt by filtering of air using minimum 30% efficient filters or straining of fluids, and replacing as often as necessary to keep mechanical systems reasonably clean and dust free and replacement at turnover to owner.
4. Place all systems into operation, when weather or other considerations require their use. Perform repair, adjustment and balancing operations as often as required to assure satisfactory operation before final acceptance.
5. Check, test and adjust pressure reducing and relief valves, thermometers, gauges, meters, safety controls and devices, and other instruments and controls to assure proper operation.
6. Tests:
 - a. Make necessary tests to provide leak-proof and code-tested system under operation. Make tests before work is concealed or covered and perform all necessary repairs as required or as otherwise indicated by test results.
 - b. See subsequent trade sections for additional requirements.
 - c. Soil, waste, and vent piping shall be closed and tested with water at head equal to highest fixture.
 - d. Domestic hot and cold water piping and all heating lines shall be tested at 125 PSI. Gas piping shall be tested at 125 PSI with soap bubbles.

G. Adjustments and Balancing:

1. Subsequent to the installation of the heating, piping, and air distribution systems and upon the beginning of operation, the Contractor shall make all necessary adjustments to equipment, control dampers, fans, and any other equipment installed by him under this Contract so as to ensure proper operation of the same. The Contractor shall be responsible for balancing the air system to deliver the air quantities shown on the Plans. This shall include changing fan speeds, belts, drive sheaves, and drive guards as required to properly balance these systems. The Contractor shall be responsible for balancing the hydronic system to deliver the flow required to service each device as shown on the plans. This shall include changing impellers, pumps, auto flow control valves and circuit setters, as required to properly balance these systems. The Contractor shall have an independent AABC or NEBB subcontractor submit (2) copies of his balancing work sheets indicating preliminary and final results. All balancing shall be performed as specified in the SMACNA Manual and ADC Standards. **Balancing must be completed and report submitted before Engineer completes final check list.**

3.03 GUARANTEES AND WARRANTIES

- A. All labor, materials and equipment shall be guaranteed by Contractor and/or warranted by the Manufacturer for one year after acceptance date and/or one normal continuous complete season's operation applicable to equipment or system except where specified longer for special equipment. Contractor shall secure such warranty from all Suppliers or the Contractor will assume the warranty and issue an Insurance Policy to the owner.
- B. Acceptance date of substantial completion shall be Owner occupancy as determined by Architect/Engineer.
- C. Contractor shall make all necessary alterations, repairs, adjustments, and replacements during guarantee periods as directed by Architect/Engineer to comply with Drawings and Specifications at no cost to Owner. The Contractor shall repeat as often as necessary to give satisfactory system in opinion of Engineer.
- D. Repair or replacements made under guarantee shall bear further one year guarantee from date of acceptance of repair or replacement.

3.04 COMMISSIONING SERVICES

- A. All services and requirements of the commissioning agent (CA) shall be completed in a timely manor.
- B. All reports, training, and TAB services shall be completed as required in construction documents.

END OF SECTION

NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS SPECIFICATION IS COPYWRITTEN.

PART 1 - GENERAL

This Specification is intended to describe general mechanical systems' methods and materials.

1.01 RELATED WORK

- A. Section 230000 - Mechanical General Provisions
- B. Section 260000 - Electrical General Provisions

1.02 WORKMANSHIP

- A. Install work in accordance with best practice of trade.
 - 1. Install new piping and ductwork straight and true with no unnecessary offsets and parallel with walls, beams, floors, or ceilings.
 - 2. Install new piping so as to be completely drainable. Provide drain cocks and capped hose adapters at all low points in piping system.
 - 3. Provide for expansion and contraction of piping at bends or risers. Install piping so as to be free from pockets due to sagging.
 - 4. Where no elevation is indicated, piping and ducts suspended above and/or below ceilings shall be hung as high as possible.
 - 5. No piping shall be installed in a manner which will interfere with necessary passage or head room, with operation of any doors or windows, with ductwork, lay-in ceiling panels, lighting outlets or fixtures, or Owner's equipment.
 - 6. No piping over electrical equipment, elevator machine rooms, electrical rooms, and telephone rooms without prior approval from Architect/Engineer.

1.03 PIPES AND PIPE FITTINGS

A. General:

- 1. Coordinate with work of other trades. Piping shall not be supported from ductwork or piping of other trades.
- 2. Support piping from structure using approved hangers; pipe straps shall not be permitted.
- 3. Allow for adequate expansion and contraction while maintaining alignment. Provide expansion joints or loops as required.
- 4. Use reducing fittings when changing pipe sizes. Bushings and "Orange Peeling" shall not be permitted.
- 5. Terminate piping to fixtures and equipment furnished by others including stop valves.
- 6. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- 7. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- 8. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged) which effectively isolate dissimilar metals, to prevent galvanic action, and stop corrosion.
- 9. Install flanges in piping 2-1/2" and larger, adjacent to each valve, at the final connection to each piece of equipment, and elsewhere as indicated.
- 10. Install sectionalizing valves at main branch lines where branch connects into mains.
- 11. Fit all openings in piping with temporary plugs and caps during construction.
- 12. Insulating couplings shall be installed at all locations where copper piping connects to other metals and in gas piping at meter connections.
- 13. If leak occurs, pipe or fitting shall be replaced with new length or fitting. Ream out all pipe ends.

Clean out debris and excess oil before installing. Use approved lubricant for all threaded joints. Do not stop leaks by adding caulking to joints.

14. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade of floors, unless indicated otherwise.
15. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
16. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained. Refer to Architectural Drawings or Plans indicating walls, floors, or ceilings requiring ratings and the amount of rating.
17. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2" with reinforced top. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
18. Drip Pan Installation: Locate drip pans under piping, passing over or within 3" horizontally of electrical equipment, under roof relief vents, and elsewhere as indicated. Hang from structure with rods and building attachments, attach rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

B. Sleeves and Escutcheons:

1. Piping passing through concrete and masonry walls and floors shall be sleeved; wall sleeves shall be cut back 3/8" from face of wall.
2. Sleeves shall be fabricated from sections of steel pipe, 1/2" to 1" larger than pipe or insulation.
3. Sleeves passing through floors shall extend 3/8" above floor. Void between sleeve and pipe shall be caulked water tight. Use fire-rated sealants at rated floors and walls.
4. Sleeves shall be permanently mortared in.
5. Where pipes pass through exterior walls, seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal. Pipe to be sealed with 100% Silicone caulking to create an air tight seal.
6. Wherever pipes are exposed and pass through walls, floors, partitions, or ceilings, they shall be fitted with chromium plated escutcheons, held in place by internal spring tension. Escutcheons shall be large enough to fit over insulation on insulated pipes.
7. Plumbing vent stacks passing through roofs shall have a vent collar/seal installed.

C. Pipe Joints:

1. Steel Pipe Joints:

- a. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is to be used.
- b. Pipe Larger than 2": Weld pipe joints for steel pipe (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.

2. Brazed and Solder Joints: For copper tube and fitting, braze joints in accordance with ANSI B31.1.0 - Standard Code for:

- a. Pressure Piping, Power Piping; ANSI B9.1 - *Standard Code for Mechanical Refrigeration*.
- b. Solder: Type of solder shall conform to following schedule:
 - Hot and cold water and recirculating lines - lead free solder.
 - Heating piping - lead free solder.
 - Drain piping - lead free material if possible.
 - Condensate drain piping - lead free solder
 - Refrigerant hot gas and liquid lines - silver braze.
 - Refrigerant suction lines - silver braze.
 - Refrigerant line connections to equipment - lead free solder.

3. Welding:

- a. Qualifications: Welders shall be qualified according to provisions of *ASME Standard Qualifications for Welding Procedures, Welders and Welding Operators, or ASME Boiler and Pressure Vessel Code* for class of piping being welded. Submit welding qualifications for all welders on project when requested by Engineer.
- b. Welding Procedure: Preparation of base metals and welding procedures shall conform to ASME American Standard Code for Pressure Piping.
- c. Filler Material: Conform to ASTM Specifications compatible with base metal being welded.
- d. Field Fabricated Fittings: Mitered or segmental elbows, swages, orange-peel, bull plugs, or similar construction will not be permitted.
- e. Branch Connections: Welding of branch connections directly to run will be permitted in lieu of tees, laterals, or crosses when branch sizes are less than 1/2 of main size unless detailed otherwise. Branch pipe shall not project beyond inside of main. Failure to comply with accepted standards of workmanship in making weld-in branch lines shall require that these connections be removed and replaced with ASA B 16.9 fittings.

4. Caulked Joints:

- a. Provide thick ring of oakum tightly into hub of pipe, pour hub full of non-lead material and caulk. Connections between steel and cast iron pipe shall be caulked with oakum and non-lead material.
- b. Tyler "XH" extra heavy TY-Seal Gaskets may be used in lieu of caulked joints for buried cast iron pipe.

- 5. Mechanical Joints or Shove-On Joints:** Follow manufacturer's recommendations for joint assembly. Provide socket clamps with tie rods at all dead ends, run outs, direction changes, and similar locations where other means of anchoring are not provided.

D. Pipe:

1. Steel Pipe:

- a. Highest quality, mild steel.
- b. Manufacturer's name shall be stamped or rolled into each length of pipe.

2. Black Steel Pipe:

- a. Pipe: Schedule 40, ASTM-A-120.
Use: Above ground gas piping.
- b. Screwed Fittings:
Use: 2" and under accessible locations.
 - i. Type: 150# malleable iron-banded.
 - ii. Unions: Ground bronze to iron seat with extra heavy body and nuts.
 - iii. Nipples: Same as pipe, except use Schedule 80 for short and close nipples.
- c. Welded Fittings:
Use: Over 2" and non-accessible locations.
 - i. Type: 150# W.P. - conforming to ASTM A234 Grade WAPB, and U.S.A.S. B 16.9 butt weld.
 - ii. Elbows: Long radius, butt weld.
 - iii. Unions: Companion flanges, 150# raised face, slip-on conforming to U.S.A.S. and ASTM specifications; use welding neck flanges at pump connections. Flanges shall have American

Standard Template drilling.

3. **Galvanized Pipe:** Schedule 40, ASTM A-120. Screwed fittings for waste, drain, and vent piping.

E. Sanitary Pipe and Storm Water Pipe and Fittings:

1. ABS Pipe:

- a. Sanitary Sewer and Storm Water Piping, Buried Beyond 5 Feet of Building: ABS pipe: Schedule 40 ASTM F 628 or ASTM D 2282 – 99(2005). Fittings: ABS.
- b. Sanitary Sewer and Storm Water Piping Above Grade (In Exposed Areas): ABS pipe: If used in exposed areas, piping must be covered with minimum 1" fiberglass insulation with approved fire resistance rating. **NOTE:** Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling inside a building. Not approved for vertical runs in interior walls.

2. PVC Pipe:

- a. Sanitary Sewer and Storm Water Piping, Buried Beyond 5 Feet of Building: PVC pipe: ASTM D3033 or D3034, SDR 35. Fittings: PVC. Joints: ASTM F477, elastomeric gaskets.
- b. Sanitary Sewer and Storm Water Piping, Buried and Above Grade, but Concealed Within Building: PVC pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld. **NOTE:** Concealed is defined as a pipe that is contained within a wall or in a fire rated chase.
- c. Sanitary Sewer and Storm Water Piping Above Grade (In Exposed Areas): PVC pipe: ASTM D2665, D3034. Fittings: PVC. Joints: ASTM D2855, solvent weld. If used in exposed areas, piping must be covered with minimum 1" fiberglass insulation with approved fire resistance rating. **NOTE:** Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling inside a building.
- d. Not approved for vertical runs in interior walls.

3. Cast Iron Pipe:

- a. Sanitary Sewer and Storm Water Piping Above Grade (In Exposed Areas): Cast iron ASTM A74; C1SP1 301. Fittings: ASME B16.4; ASME B16.12. **NOTE:** Exposed is defined as a pipe that is exposed to view or installed above an accessible ceiling.
- b. **All vertical runs of Sanitary Sewer and Storm Water are to be run in Cast Iron.**

4. **Chrome Plated Drain Lines:** Use chrome plated drain lines for all exposed piping under sinks, etc.

F. Copper Pipe and Fitting (Domestic Water - Above Ground/Underslab & Heating):

1. **Pipe:** Conform to ASTM Specifications. Pipe shall be color coded or marked at factory for identification. Tubing shall conform to following:
 - a. Above Ground: Type L hard drawn, ASTM B-88.
 - b. Buried: Type K, annealed temper, ASTM B-88.
 - c. Refrigeration: Type ACT, hard drawn, ASTM B-280.
 - d. Drainage: Type DWV, ASTM B-306.
 - e. Exposed: Use chrome plated piping for all exposed domestic water piping for sinks, toilets, urinals, etc.
2. **Fittings:**
 - a. General Service: Sweat type, wrought copper (cast fittings permitted only where wrought copper is not manufactured). Long radius elbows.
 - b. Drainage: Sweat type, wrought copper, drainage pattern. Specialty items such as closet elbows may be cast brass.

G. Plastic Pipe and Fittings (Domestic Water - Underslab):

- a. Pipe: Schedule 80 ABS - conform to ASTM D2282-99(2005) and MIL-STD-129, 160 psi working pressure.
- b. Fittings: ABS

H. Grooved Piping:

1. **Pipe:** Schedule 10 ASTM A-120 with factory supplied roll grooves that meet grooved coupling manufacturer=s latest specification. All field roll grooves must be measured with a pi-tape and meet specification prior to coupling assembly. **Note:** This assembly method is important and joints will be randomly field checked by the engineer.
2. **Gaskets:** Gaskets must be Grade E with a Flushseal center leg design as provided by Victaulic Company of America or engineer approved equal. All product submittals must be approved prior to bidding. All gaskets must be lubricated with a non-petroleum based lubricant compatible with the grooved coupling manufacturer=s gasket. Approved grooved coupling manufacturers: **Victaulic only.**
3. **Fittings:** All grooved fittings must be domestic and of one manufacturer. All grooved fittings must be manufactured of ASTM A-536 Ductile Iron. Approved grooved fittings manufacturers are **Victaulic Company of America.**
4. **Couplings:** All grooved couplings must be domestic and of one manufacturer. All couplings shall be Zero-Flex Arigid@ design. All couplings must be installed as per the manufacturer=s latest recommendations. Provide all necessary anchors, supports and restraints per the manufacturer=s recommendations for all grooved pipe systems. Three (3) flexible grooved Style 77 or 75 couplings may be used at all pumps in lieu of flex connectors.
5. **Grooved Valves:**
 - a. All grooved butterfly and check valves must be of one domestic manufacturer and shall be rated to 300 PSI. All grooved valves shall have an internal and external PPS coating and the disc liner must be consistent with that of the grooved coupling gasket and be compatible for the service. All grooved butterfly valves must have a blowout proof stem. The disc and stem must be of a one piece ductile iron construction.
 - b. Butterfly Valves 2" - 6" must have a 10 position lever lock handle and valves above 6" must have a gear operator.
 - c. Tour & Anderson circuit balancing valves series 787 threaded, series 786 solder end & 789 grooved end arc are approved for heating services.
6. **Straining Devices:** Victaulic S/730 Tee strainer & 731 Suction Diffuser are approved for heating services.

1.04 VALVES

- A. All valves shall be of same manufacturer.
- B. Where grooved piping system is specified, groove end butterfly valves equal to **Victaulic.**
- C. Valves are rated for 125 PSI service. Provide higher rated (250) PSI valves per system requirements.
- D. Valves shall be submitted with shop drawings for various uses.
- E. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- F. Install globe valves for throttling, bypass, or manual flow control services.
- G. Provide spring loaded check valves on discharge of water pumps.

1.05 PIPING SPECIALTIES

- A. General:** All piping systems shall be complete with all specialties and appurtenances required for complete operating system.
- B. Expansion Loop Guides:** Two installed on each side of loops, securely anchored to building structure.
- C. Expansion Joints:** Iron body, internal guides, stainless steel bellows. Piping shall be properly guided at all expansion joints and at intermediate locations as recommended by manufacturer.

D. Mechanical Type Couplings: Victaulic.

E. Insulating Couplings: Install at all locations where copper tubing connects to galvanized iron pipe and gas piping at meter connections.

F. Strainers and Filters:

1. Strainers: Strainers shall be Y pattern, 125# W.P. iron body for general use and 250 p.s.i. WSP for high pressure process and hydraulic use.

a. Screwed: For piping 2" and smaller.

b. Flanged or Grooved: For piping 2-1/2" and larger.

c. Screens: Monel, cylindrical, reinforced ends. 20 mesh for water; 40 mesh for air, gas.

G. Vacuum Breakers and Backflow Preventers

1. General: Vacuum breakers and backflow preventers shall be installed in accordance with all applicable codes and as specified.

2. Vacuum Breakers:

a. Domestic Service: Vacuum breakers shall be provided on all flush valves, hose faucets, laboratory sinks, chemical vats, laundries, swimming pools, process equipment, fittings, and fixtures covered by codes. Vacuum breakers shall be chrome plated where located exposed in finished portions of building.

b. Installation: Vacuum breakers shall be installed above highest fixture they are protecting in such manner that it will preclude back pressure. Vacuum breakers shall be installed where they will be accessible for periodic testing and where spillage will not be objectionable.

3. Backflow Preventers:

a. General: Backflow preventers shall be installed in all systems where domestic water is subject to contamination due to reduced pressures causing backflow such as heating and cooling system make-up water, lawn sprinklers, and all areas designated by local codes as health hazard. Backflow preventers may serve more than one piece of equipment or system as long as cross contamination between systems is not objectionable. Backflow preventers shall be of reduced pressure, dual, spring loaded, check; intermediate vacuum breaker.

b. Installation: Backflow preventers shall be installed in horizontal position in open accessible for maintenance and periodic inspections and testing. Backflow preventers shall be piped with drain line to nearest floor drain. Drain shall terminate at floor drain with minimum of 12" air gap and in area not subject to flooding or freezing.

c. Drain Pan: Install galvanized drain pan under all backflow preventers installed above ceilings, pipe 3/4" copper line from drain pan to nearest floor drain or mop sink. Pan shall be 3" wider and longer than backflow preventer size. Depth of drain pan shall be 1-1/2".

1.06 GAUGES AND THERMOMETERS

A. Gauges: Provide 4-1/2" face glass, aluminum body pressure gauges with adjustable pointer, gauge cocks, and shock reducing snubber. Each gauge shall be labeled to indicate units in "PSI" or "FT-HD" on gauge face. Gauge pressure shall be selected to give approximately two (2) times pressure that gauge will encounter constantly. (Example: 15 PSI steam gauge range 0 to 30 PSI.) Install at following locations or as indicated on prints.

1. All heating pumps' inlets and outlets.

2. All domestic hot water pumps' inlets and outlets.

3. Cold water supply at meter outlet or connecting point where cold water supply for new addition connects to old line (if in exposed location).

4. Water meter inlet and outlet.

B. Thermometers: Thermometers shall be installed on water side and set so that they do not restrict or obstruct fluid flow. Install at following locations or as indicated on prints.

1. At each heating return line balancing valve that occurs in return main where two or more heat users return water to it.
2. At all three ports of 3-way valves.
3. At domestic hot water tank supply and return pipes, near pump.
4. At inlet and outlet of hot water heating coils.
5. At boiler inlet and outlet.

1.07 DUCTWORK

A. General:

1. Before proceeding with fabrication and installation of ductwork, inspect the contract documents, site conditions and truss shop drawings and determine that the location of work does not interfere with other work. In case of interference, notify the Engineer.
2. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
3. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
4. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum length of flexible duct only in accessible areas where a ceiling is installed. Hold in place with strap or clamp.
5. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
6. Where ductwork, structure, etc. can be seen behind grilles, registers, diffusers, etc. apply flat black paint to all visual surfaces.

B. Ductwork:

1. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.
2. Steel Rectangular Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per square feet for each side in conformance with ASTM A90.
3. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F.
4. Round Spiral Ducts: ASTM A-527-71, galvanized steel, spiral locking seam equal to United McGill Uni-Seal. For underslab ductwork, use United McGill Uni-Coat.
5. Internal Insulated Round Spiral Ducts: ASTM A-527-71, galvanized steel, spiral locking seam equal to United McGill Uni-Rib k-27.
6. Stainless Steel Ducts: ASTM A167, type 304.

1.08 SUPPORTS AND ANCHORS

- A. General:** Furnish and install all necessary pipe hangers, rollers, and duct hangers required for all systems. Hanger rod shall be all-thread carbon steel type. Rod shall conform to ASA B1/1960 Class 2A fit.
- B. Ductwork:** Supports and hangers for ductwork and appurtenances shall conform to *Manual of Sheet Metal and Air Conditioning Contractors Association, Inc. and latest edition of American Society of Heating, Refrigeration, and Air Conditioning Engineers Handbook* Ducts 36" x 12", or equivalent, and larger, shall be supported by trapeze type hangers.
- C. Pipe Hangers:** First two piping supports away from new mechanical equipment supporting 1" diameter pipe or larger shall be isolated from structure by means of vibration and noise isolators. This piping shall be isolated with Type "H" Hangers. Floor mounted piping shall be isolated with Type "S" Spring Mounts for first two supports. Flexible members shall be incorporated in piping adjacent to all reciprocating

equipment. Where steel supports contact copper lines, isolate copper from support with PVC sleeve to prevent galvanic corrosion.

1. Vertical Piping:

- a. Wall mounted support spacing shall be on not more than 12' centers. Wall support shall be electro-galvanized pipe clamp with at least 12" of electro-galvanized 1-5/8" x 1-5/8" 12 gauge steel channel anchored to wall with at least two 1/4" Ramset plated threaded fasteners with 1" or more wall penetration.
- b. Vertical pipes through floors shall be supported at each floor. Support shall consist of riser clamp. In addition to clamp, attach 1/2" dia. by 1/2" long stud to pipe just above clamp to prevent slipping of pipe. Stud shall be of same material as supported pipe.

2. Horizontal Piping: Clevis hangers blacksteel or approved equal with threaded rods and jamb nuts. Maximum pipe hanger spacing for Schedule 40 steel pipe shall be as follows:

- a. 3/4" to 2" pipe on 8' centers with 3/8" rod.
- b. 2-1/2" to 3" pipe on 10' centers with 1/2" rod.
- c. 4" on 14' centers with 5/8" rod.
- d. 6" to 8" pipe on maximum of 17' centers with 3/4" rod. (Use maximum 10' centers on precast plank.)
- e. 8" pipe - 19' span with 7/8" rod.

3. Attachment to Structure:

- a. Steel Joist Attachment: Grinnell #87 malleable iron "C" clamp (2" pipe and smaller) with lock nut and retaining clips. Grinnell #229 and #292 (2-1/2" pipe and larger) attach to upper or lower web of joists as conditions require and only at panel joints, with two "C" clamps, and two rods, and two clevis hangers so that joist is symmetrically loaded. Line sizes 1-1/2" and smaller may be hung with only one hanger.
- b. Steel Beam Attachment: Grinnell #87 malleable iron "C" clamp (2" pipe and smaller) with lock nut and retainage clips. Grinnell #229 and #292 (2-1/2" pipe and larger) attach to either upper or lower flange as field conditions require with one hanger.
- c. Wood Beams and Purlins (for piping under 4" only): Grinnell #142 1/2" diameter lag screws with bolt thread head of black steel. Length shall penetrate not less than two-thirds of member depth. Use welded eye rods such as Grinnell #287 black steel of rod diameter specified above. Use 3/8" diameter lag screws for piping 1-1/2" and smaller.
- d. Wood Trusses: Suspend piping from the building structure using one of the following methods:
 - i. Piping Under 2" Only: Install Grinnell #142 1/2" diameter lag screws with bolt thread head of black steel. Length shall penetrate not less than two-thirds of member depth. Use welded eye rods such as Grinnell #287 black steel of rod diameter specified above. Use 3/8" diameter lag screws for piping 1-1/2" and smaller.
 - ii. Piping 2" and Larger: Install uni-strut (trapeze) anchored to the top side of the roof truss bottom chord and then suspend down to a trapeze bar and/or a clevis hanger.
- e. Concrete and Masonry Surfaces: Attachment to horizontal poured concrete surfaces shall be by concrete inserts or expansion sleeves. Attachment to vertical poured concrete surfaces or masonry surfaces shall be by concrete inserts, expansion sleeves, and Ramset or Hilti fasteners. Attachment to precast concrete construction shall be by use of rod passing through plank on joints and with plate not less than six times diameter of rod by 1/4" thick plus nut on top surface of plank.
- f. Rooftop: Use prefabricated curb pipe support. Unit shall be built of not less than 18 gauge galvanized steel and constructed for use on the specific roof type for this project.
- g. Roof-Top Equipment Supports:
 - i. Unless indicated otherwise on Drawings, roof-mounted equipment shall set on prefabricated equipment support rails. Support rails shall be of monolithic construction, 18 gauge

galvanized steel, continuous mitred and welded corner seams, integral base plate, factory installed 2 x 4 wood nailer, and 18 gauge galvanized steel counter-flashing.

- ii. Support height shall be selected so that support rails bear on metal or concrete roof deck and project minimum of 8" above top surface of roof, or as specified on drawings, and at least one foot beyond edge of equipment which it supports. See Drawings for possible additional requirements.

h. Anchors and Guides:

- i. Anchor all pipes as required and/or where indicated in Contract Documents. Anchors shall properly distribute expansion and shall be securely attached to supporting construction to satisfaction of Architect's Field Representative.
- ii. Provide semi-steel spider and guiding cylinder pipe alignment guides on all piping in all areas. Pipe alignment guides shall be spaced as required according to manufacturer's design criteria and recommendations (minimum of two guides on each side of expansion joints and loops). Pipe alignment guides shall serve to guide expanding pipe to move freely from anchor points to expansion joints, loops, or bends. Guides shall be of same manufacturer as expansion joints.

1.09 **PUMPS**

- A. **General:** Pumps shall be sized and selected to provide specified flow rate at specified pressure difference. If pumps installed cannot provide both design conditions of flow rate and pressure difference, make any or all changes to pumps to achieve design conditions at no additional cost to Owner. This change may include, but is not necessarily limited to the following; change impeller size, change motor size, or change entire pump. If motor size is increased, resulting in electrical changes, Mechanical Contractor shall compensate Electrical Contractor for cost of change.
- B. Piping connections to pumps shall be same size as pump connection or larger with reducing fittings installed as close as possible to pump connection.
- C. Shut-off and check valves shall be same size as line size.
- D. Elbows shall occur at least 7 pipe diameters from pump suction. (When used instead of suction diffuser.)
- E. Piping shall be supported by other means than pump connections. Piping shall be properly supported before connections are made.
- F. Avoid air pockets in suction piping; horizontal piping shall pitch up to pump.
- G. Suction and discharge piping shall be provided with pressure gauges and needle valves.

H. **Hot Water Circulating, and Miscellaneous Pumps:**

1. Furnish and install pumps of size, type and capacity as indicated.
2. Pumps shall be complete with motors, pump base, couplers, seals, tapped gauge openings, etc. for complete assembly. In-line pumps may be installed without flex conditions.
3. Pumps shall be installed, aligned, and started in accordance with manufacturer's recommendations. Pump suction sizes shall not be less than those indicated in Schedule. Pumps shall be selected for and designed for quiet operation.

1.10 **MOTORS**

- A. **Ratings:** Motors shall meet NEMA Standards and shall be capable of operating at rated load with voltage variation of plus or minus 10%, rated frequency variation of plus or minus 5%, or combined variation of 10% without damage to motor.
- B. **Selection:** Motors shall be selected for type of service involved and shall be selected at minimum of 15% above required rating of equipment served. Provide "quiet rated" motors where required.

1.11 **BELT AND SHAFT GUARDS**

- A. **Requirements:** All open drives on fans, pumps, compressors, and other similar drives shall be provided with guards in accordance with MIOSHA and all safety and construction codes.
- B. **Belt Drives:** Compressors, fans, and equipment with sheave and pulley drives shall be provided with

guards in accordance with MIOSHA and all safety and construction codes.

- C. **Coupling Drives:** Direct motor coupling drives shall be provided with guards. Guards shall be extended to include shafts.
- D. **Extended Shafts:** Equipment with extended shafts for dual bearings shall be provided with guards to cover entire shaft.
- E. **Walk-In Equipment:** Equipment designed for walk-in service shall be provided with guards.
- F. **Guards:** Guards shall be constructed of extra heavy gauge metal, formed to fit over protected items and securely fastened to equipment or floor. Provisions shall be made for access at test openings and allowance for motor adjustments. Guards shall allow for ample clearance of pulley, drives, and couplings. Guards shall be prime coated and finished in enamel to match their respective equipment.

1.12 ACCESS DOORS: Steel access doors and frames, factory-fabricated and assembled, complete with attachment devices and fasteners for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

A. Frames: 16-gage steel, with a 1-inch wide exposed perimeter flange.

1. For installation in masonry, ceramic tile, or wood paneling: 1-inch wide exposed perimeter flange and adjustable metal masonry anchors.
2. For gypsum wallboard or plaster; perforated flanges with wallboard bead.
3. For full-bed plaster applications; galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

B. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
2. Locking Devices: Flush, screwdriver-operated cam locks.

1.13 MECHANICAL IDENTIFICATION

A. General: All system components shall be identified to allow proper operation and maintenance.

B. Valve Identification: Label valves with brass tags on chain (1/2" letters). Prepare typewritten valve tag schedule indicating label, size, type, and function of each valve for inclusion in operation and maintenance manual. Also, mount plastic-encased copy of same in mechanical room.

C. Pipe Identification:

1. Label all pipes with stencil labeler (1-1/2" characters), this includes flow arrows.
2. Label all pipes where they are exposed, at change of piping direction, and every 50 feet at long straight runs.

D. Pipe and Duct Identification: All pipe covering, insulation work, and piping installed, except concealed or metal and aluminum foil jacketed work, shall be painted to match room/structure finish.

1.14 MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL

A. General: Entire mechanical system shall be installed to provide quiet and vibration free environment in occupied spaces. Contractor shall replace or repair equipment and/or provide additional sound and vibration control equipment if Architect/Engineer deems system or its components do not meet design criteria for sound and vibration.

B. Vibration Isolation Supports and Hangers:

1. All mechanical equipment over 1 horsepower, unless otherwise noted, shall be isolated from structure by means of resilient vibration and noise isolators supplied by single manufacturer. Where isolator type and required deflection are not shown or tabulated, equipment shall be isolated in accordance with latest version of ASHRAE Systems Handbook. Isolator manufacturer's submittal shall include complete design for supplementary bases, tabulation of design data on isolators, including outside diameter, free, operating, and solid heights of springs, free and operating heights of neoprene, or fiberglass isolators.

- C. Pipe Hangers:** Refer to Section 1.07.
- D. Vibration Isolation and Expansion Compensation:** Furnish and install all vibration isolators, flexible connections, expansion joints, and expansion loops required to reduce noise transmissions and stress on equipment and piping.
- 1. Vibration Isolation:**
- a. Locations:** Floating slabs, fans, compressors, and all motor driven equipment subject to noise transmission.
 - b. Deflection:** Selection to be made in conjunction with equipment manufacturers to assure workable system.
- 2. Expansion Joints:**
- a. General:** Install piping for adequate movement without stress or damage. Provide sufficient expansion loops, changes in direction and within stress limits of ASME code. Where deflection cannot be employed to absorb expansion and contraction expansion joints should be employed.
 - b. Installation:** Joints shall be properly anchored and guided in compliance with recommendations of manufacturer of expansion joint. Refer to Paragraph 1.06.C.4.g for anchors and guides.
- 3. Flexible Connections:**
- a. General:** All equipment subject to vibration and noise transmission shall be provided with flexible connections.
 - b. Compressors:** Braided steel or bronze.
 - c. Pumps:** Braided steel or bronze. When using the Victaulic pipeline system, three Victaulic Style 75 or 77 flexible couplings may be used in lieu of a flex connector. See Victaulic TS-5000 for details.
 - d. Duct Connections to Air Moving Equipment:** Neoprene coated flame-proof fabric minimum 2" side.
- E. Spin Balance:** All new rotating equipment shall be factory balanced, both statically and dynamically. If any equipment is determined by Architect/Engineer to be unbalanced after installation, equipment shall be electronically in-place spin balanced according to balancing criteria as set forth in latest *Systems Edition of ASHRAE Handbook*. Before and after readings shall be submitted in writing for Architect/Engineer's review.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL - PIPING

A. Installation:

1. Establish elevations of buried piping outside the building to ensure not less than minimum cover by code.
2. Establish invert elevations, slopes for drainage to 1/8" per foot, one percent minimum. Maintain gradients.
3. Install valves with stems upright or horizontal, not inverted.
4. Install unions downstream of valves and at equipment or apparatus connections.
5. Install brass male adaptors each side of valves in copper piped system. Sweat solder adaptors to pipe.
6. Install nail stoppers at all pipe/wall stud intersections (both sides). Nail stoppers to be equal to Simpson "Strong-Tie" Model "NS".

B. Testing: Refer to individual piping system specification sections for testing specifications. If testing specifications are not given in individual section, test piping system as follows:

1. Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each section of each piping system independently, but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
 - a. Required test period is 2 hours.
 - b. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
 - c. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
 - d. Record date of each test and results in a log which shall be turned over to Architect/Engineer at completion of Project.
2. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-lead compounds, mastics, or other temporary repair methods.

C. Disinfection of Domestic Water Piping System:

1. Prior to starting work, verify system is complete, flushed, and clean.
2. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
3. Inject disinfectant - free chlorine in liquid, powder, tablet, or gas form - throughout system to obtain 50 to 80 mg/L residual.
4. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
5. Maintain disinfectant in system for 24 hours.
6. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
7. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601.

3.02 FIELD QUALITY CONTROL - DUCTWORK

A. Installation:

1. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Use splitter dampers only where indicated.
2. Provide fire dampers or combination fire and smoke dampers at locations where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.
3. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.
4. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
5. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
6. Provide support for all diffusers/grilles in any ceiling structure with a non-exposed-to-view support system. System is to support diffuser/grille and associated ductwork without adding weight to ceiling tile.

B. Duct Sealants:

1. Duct systems, including all seams, joints, fastener penetrations and connections, shall be effectively sealed in accordance with SMACNA Seal Class A requirements, and leak tested with total allowable leakage from high and medium pressure (4" W.C. or greater) ducts not to exceed one (1) percent of the total system design airflow rate. Joint sealants shall have fire and smoke hazard rating as tested by ASTM D-2202 Exterior mastic sealant shall be certified to pass 500 hours QUV. Sealants shall also comply with ASTM freeze/thaw standard C731 and D2202.
2. Manufacturer, upon request shall be able to properly document an established record of experience and success in the specialized formulation of duct sealants, elastomeric tapes, and adhesives.
3. All duct work shall be suitably cleaned and prepared, and sealant applied in strict accordance with manufacturer's recommendations for cure time shall be followed before pressure testing is begun. Any additional paint or coatings must conform to manufacturer's specifications.
4. Sealant Manufacturer: **AMF Safecoat Dynoflex, United Duct Sealer (Water based Uni-Mastic 181)**

3.03 SELECTIVE DEMOLITION

- A. Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved. Where noted or indicated to be removed, that portion of the existing mechanical systems are to be disconnected, taken down, removed from Owner's property and properly disposed of by the Contractor.
- B. Materials and Equipment to be Salvaged:** Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
 1. Where noted or indicated to be removed and turned over to the Owner, that portion of the existing mechanical systems are to be disconnected, taken down and moved to a location where the Owner wants it stored.
 2. Where noted or indicated to be removed and reused, that portion of the existing mechanical systems are to be disconnected, taken down, stored in a clean, dry location by the Contractor until such time as the Contractor shall reinstall. The portions of the reused mechanical system which can be cleaned of rust, sludge, etc. shall be cleaned before reinstalling. If existing surfaces are painted, such surfaces shall be touch-up painted or repainted after reinstallation.
- C. Job Conditions:**
 1. While the drawings indicate certain existing mechanical systems or other materials are to be reused or removed, Contractor shall not consider these notations as showing all items in the area. The notations are general in nature and are to establish the intent and nature of work and apply to all mechanical items in the area.
 2. Certain mechanical materials that must be removed are concealed in walls or ceilings are not shown but shall be removed when walls are removed at no cost to the Owner.
 3. If the existing occupied facility is to stay in operation throughout the entire remodeling period, mechanical services for the occupied facility shall be completely operable and shall function continuously while remodeling work is completed.
- 4. Mechanical Materials and Equipment:** Demolish, remove, demount, and disconnect the following items:
 - a. Inactive and obsolete HVAC equipment, piping, fittings and specialties, equipment, ductwork, controls, fixtures, and insulation.
 - b. Piping and ducts imbedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove materials above accessible ceilings. Drain and cap piping and ducts allowed to remain.
 - c. Installation and Removal: Where walls are to be removed and existing piping or ductwork is uncovered which must be reused to serve a section of the building other than this remodeling area, it shall be this Contractor's responsibility to reroute and provide permanent piping to replace that which is removed. Unused piping and ductwork shall be removed to 2" below disturbed surfaces

and capped.

END OF SECTION

NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS SPECIFICATION IS COPYWRITTEN.

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Pipe, duct, and equipment hangers, supports, and associated anchors.
- B. Sleeves and seals.
- C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED WORK

- A. Section 230516 - Expansion Compensation
- B. Section 230700 - Thermal Insulation

1.03 REFERENCES

- A. Conformance with ANSI/ASME B31.1 - Power Piping.
- B. Conformance with NFPA 13 - Standard for the Installation of Sprinkler Systems.
- C. Conformance with Manufacturer's Standardization Society MSS SP-90.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 230000.
- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 2 Inch: Malleable iron carbon steel, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2-1/2 to 4 Inches and Cold Pipe Sizes 6 Inches and Over: Carbon steel, adjustable, clevis.
- C. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.
- E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- F. Wall Support for Pipe Sizes to 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support for Pipe Sizes to 4 Inches and all Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- I. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- J. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- K. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.
- L. Shield for Insulated Piping 2-1/2 Inches and Larger (Except Cold Water Piping): Pipe covering protective saddles.
- M. Shields for Insulated Cold Water Piping 2-1/2 Inches and Larger: Hard block non-conducting saddles in 90° segments, 12 " minimum length, block thickness same as insulation thickness.

2.02 HANGER RODS

- A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

- A. Metal Flashing: 26 gauge galvanized steel.
- B. Flexible Flashing: 47 mil thick sheet compatible with roofing.
- C. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.05 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Floors: Form with steel pipe or 18 gauge galvanized steel.
- B. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated sleeves including seals, UL listed.
- C. Sleeves for Round Ductwork: Form with galvanized steel.
- D. Sleeves for Rectangular Ductwork: Form with galvanized steel or wood.
- E. Fire Stopping Insulation: Glass fiber, type, foam or cement type to be equal or greater than rating of structure being penetrated.
- F. Caulk: Acrylic sealant.

2.06 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.
- C. Provide copper plated hangers and supports for copper piping.

2.07 FINISH

- A. Prime coat or factory galvanize exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 EXECUTION

3.01 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- D. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut flush with top of slab.

3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as follows:

<u>PIPE SIZE</u>	<u>MAX. HANGER SPACING</u>	<u>HANGER DIAMETER</u>
1/2 thru 1-1/4 inch	6'-6"	3/8"
1-1/2 thru 2 inch	10'-0"	3/8"
2-1/2 thru 3 inch	10'-0"	1/2"

4 thru 6 inch	10'-0"	5/8"
8 thru 12 inch	14'-0"	7/8"
PVC (All Sizes)	6'-0"	3/8"
C.I. Bell and Spigot (or No-Hub)	5'-0"	1/2"

and at Joints

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.

3.03 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete type specified by architect or on drawings.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipe through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, shower, and mop sink drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacture's instructions for sound control.
- F. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface (or as indicated on drawings). Flexible sheet flash and counter flash with sheet metal; seal watertight.

3.05 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Extend sleeves through floors one inch above finished floor level. Caulk sleeves full depth and provide floor plate.
- C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- D. Install chrome plated steel escutcheons at finished surfaces.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Vibration Isolation Equipment.

1.02 RELATED WORK

- A. Section 221116 - Plumbing Piping.
- B. Section 232500 - Hydronic Piping.

1.03 QUALITY ASSURANCE

A. Qualifications:

- 1. Vibration isolation equipment is described hereinafter by Mason Industries, Inc. catalog or model numbers, and is intended to convey type and quality of equipment required. Similar products made by other manufacturers may be used:
 - a. Hyspan
 - b. Flexonics
 - c. Mason
 - d. Metraflex

B. Design Criteria:

- 1. The mount shall have a vibration transmissibility not exceeding 5 percent at a frequency equal to the lowest rotational speed of the system being isolated. The springs shall have a minimum static deflection of 1-inch and shall have a diameter of not less than the deflected height of the spring under the imposed loads. All springs shall be selected for uniform static deflections according to distribution of weight.
- 2. All mountings used out of doors shall have hot dipped galvanized hardware and PVC coated springs.
- 3. Separate snubbing and damping control, and horizontal and vertical stabilizer shall be used when required to control oscillations and equipment thrust.
- 4. Maintain ASHRAE criteria for average noise criteria curves for all equipment at full load condition.

C. Testing Agency:

The Contractor shall engage the manufacturer of the vibration isolation equipment to inspect and, where required, to adjust, repair and/or add isolators to comply with the intent of the specifications.

1.04 SUBMITTALS

- A. Submittal data shall include detailed calculations showing weight distribution of equipment, load, type, and deflection of each isolator.
- B. Upon completion of the inspection and after the required adjustments are made, the isolation equipment manufacturer shall submit in accordance with SECTION 230000, MECHANICAL GENERAL PROVISIONS, his report detailing actual static deflection versus designed static deflection for each isolator.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION: Materials and systems specified herein and detailed or scheduled on the drawings are based upon materials manufactured by Kinetics Noise Control, Inc. Materials and systems provided by other manufacturers are acceptable pending engineering written approval, provided that they meet all requirements as listed in this specification.

- A. Springs: All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability.

Laterally stable springs shall have k_x/k_y ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity – color striping is not considered adequate.

- B. Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be galvanized, powder-coated enamel, or painted with rust-resistant paint. Hot-dipped galvanized housings shall be provided as indicated on the Schedule.
- C. Steel Equipment Base: Bases shall be of welded construction with cross members to form an integral support platform. Structural steel members shall be designed to match supported equipment.
1. Vibration bases for fans shall have adjustable motor slide rails as indicated on their Schedule, and shall accommodate motor overhang.
 2. Bases for exterior use shall be painted or hot-dipped galvanized for complete corrosion resistance.
 3. Minimum clearance under steel equipment bases shall be 25mm (1").
- D. Concrete Inertia Base: Inertia bases shall be of welded steel construction with concrete in-fill supplied by the installing contractor on site and shall incorporate reinforcing bars, spaced 300 mm (12") maximum on centers each way.
1. Inertia bases for pumps shall be of sufficient size to accommodate supports for pipe elbows at pump suction and discharge connections (if this information has been provided for configuration).
 2. Inertia bases for fans shall include motor slide rails as indicated on their Schedule.
 3. The weight of each inertia base shall be at least (1.5 times(x)) to the weight of the equipment mounted thereon or sufficient to lower the center of gravity to or below the isolator support plane.
 4. Inertia bases shall be a minimum of 150 mm (6") thick. (See ASHRAE Standards).
- E. Isolators:
1. Free Spring Floor Mounted Isolators: Type FDS – Vibration isolators shall be free standing, un-housed, laterally stable springs wound from high strength spring steel. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (0.25") thick, bonded to the base plate. Springs shall be selected to provide operating static deflections as required. Springs shall be color coded or otherwise identified to indicate load capacity. In capacities up to 5,000 lbs., springs shall be replaceable. In capacities over 5,000 lbs., springs shall be welded to the top and bottom load plate assemblies. Springs shall be assembled between a top and bottom steel load plate. The upper load plate shall be provided with a steel leveling bolt lock nut and washer for attachment to the supported equipment. The lower load plate shall have a non-skid noise isolation pad bonded to the bottom and have provisions for bolting the isolator to the supporting structure. Spring isolation mounts for floor-mounted equipment shall be **Model FDS**, as manufactured by Kinetics Noise Control, Inc.
 2. Restrained Spring Floor Mounted Isolators: Type FLS – Vibration isolators for equipment which is subject to load variations and large external or torquing forces shall consist of large diameter laterally stable steel springs assembled into formed or welded steel housing assemblies designed to limit vertical movement of the supported equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (0.25") thick, bonded to the base plate. Housing assembly shall be formed or fabricated steel members and shall consist of a top-load plate complete with adjusting and leveling bolts, vertical restraints, isolation washers and a bottom plate with non-skid noise stop pads and holes provided for anchoring to supporting structure. Housing shall be hot dipped galvanized. Spring elements shall meet all the specified characteristics described in Section 2.1/E.1 paragraph. Vibration isolators shall be **Model FLS**, as manufactured by Kinetics Noise Control, Inc.

3. Vibration Modular Restrained Spring Isolator: Type FMS (A, B, C, D, E, F) – Spring isolators shall be comprised of two interfacing but independent elements; a coil spring element and a seismically rated housing. The spring coil element shall be comprised of one or more coil assemblies having all of the characteristics of freestanding coil spring isolators as specified in the vibration isolation portion of the specification. The seismically rated housing shall be sized to meet or exceed the force requirements applicable to the project and have the capability of accepting coils of various sizes, capacities, and deflections as required to meet the desired isolation criteria. All spring forces will be contained within the coil/housing assembly and under no seismic load condition shall the restraint anchoring hardware be exposed to spring - generated forces. The restraint element shall incorporate a steel housing with elastomeric elements at all dynamic contact points. The restraint will allow a maximum of 1/4 in. (25 mm) motion in any direction from the neutral position. All elastomeric elements shall be replaceable. To ensure the optimum anchorage capacity, the restraint will have an overturning factor (the ratio of the effective lateral snubber height to the short axis anchor spacing) of 0.33 or less. The leveling nut or screw shall be accessible for adjustment with the use of a pneumatic or electric impact wrench. The spring element shall be replaceable without having to lift or otherwise remove the supported equipment. Spring elements shall meet all the specified characteristics described in Section 2.1/E.1 paragraph. The isolator/restraint shall be **Model FMS** (A, B, C, D, E, F) as manufactured by Kinetics Noise Control, Inc.

4. Rubber-in-Shear / Fiberglass Floor Mounts:
 - a. Vibration isolators shall be pre-compressed molded fiberglass pads individually coated with a flexible, moisture impervious elastomeric membrane. Vibration isolation pads shall be molded from glass fibers with all strands oriented horizontally. Natural frequency of fiberglass vibration isolators shall be essentially constant for the operating load range of the supported equipment. Vibration isolators shall be color coded or otherwise identified to indicate the load capacity. Vibration isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents. Vibration isolation pads shall be **Model KIP**, as manufactured by Kinetics Noise Control, Inc.
 - b. Vibration isolators shall be as described as in Section 2.1/E.1 paragraph bonded to a steel load transfer plate and a formed steel bolt-down bracket, and shall also include an equipment-mounting bolt with an anti-short circuit neoprene grommet. Anchored vibration isolators shall be **Model AC** as manufactured by Kinetics Noise Control, Inc.
 - c. Vibration isolators shall be neoprene, molded from oil-resistant compounds, with cast-in-top steel load transfer plate for bolting to supported equipment, and a bolt-down plate with holes provided for anchoring to supporting structure. Top and bottom surfaces shall have non-skid ribs. Neoprene vibration isolators shall have minimum operating static deflections as shown on the Vibration Isolation Schedule or as indicated on the project documents but not exceeding published load capabilities. Neoprene vibration isolators shall be **Model RD**, as manufactured by Kinetics Noise Control, Inc.
 - d. All Direction Neoprene Isolator: Type RQ - Vibration Isolators shall be neoprene, molded from oil resistant compounds, designed to operate within the strain limits of the isolator so to provide the maximum isolation and longest life expectancy possible using neoprene compounds. Isolators shall include encapsulated cast-in-place top steel load transfer plate for bolting to equipment and a steel base plate with anchor holes for bolting to the supporting structure. Ductile iron or cast aluminum components are not acceptable alternatives and shall not be used due to brittleness when subjected to shock loading. Isolator shall be capable of withstanding the design seismic loads in all directions with no metal-to-metal contact. Isolator shall have minimum operating static deflections as shown on the project Vibration Isolation Schedule or as otherwise indicated in the project documents and shall not exceed published load capacities. Neoprene isolators shall be **Model RQ** as manufactured by Kinetics Noise Control, Inc.

- e. Neoprene Isolator: Type KRMS: **The KRMS** is a neoprene isolator with a 3-axis restraint capability. It would be usable for floor, wall, and ceiling applications. The deflection of the isolators in the, confined mode, will be between 0.25" and 0.33" depending on the rated load. The natural frequency if loaded to the rated value would be between 6.25 Hz and 5.45 Hz.
5. Spring Hangers: Vibration isolator hanger supports with steel springs and welded steel housings. The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30-degree arc without metal-to-metal contact or other short circuit. Hangers serving lightweight loads 0.90 kN (200 lbs) and less may be exempt from this requirement. *{When used in a seismic application(s), a vertical limit stop washer sized to fit the hanger rod is to be provided by others}*.
- a. Vibration isolators for suspended equipment, with minimum static deflection requirement exceeding .4", shall be hangers consisting of a free-standing, laterally stable steel spring and elastomeric washer in series, assembled in a stamped or welded steel bracket. The spring element shall meet all the specified characteristics described in Section 2.1/E.1 paragraph. The stamped or welded hanger bracket shall meet all the specified characteristics described in Section 2.1/E.7 paragraph. Shall also be fitted with a self-centering load cap for the hanger rod. Vibration isolation hangers shall be **Model SH**, as manufactured by Kinetics Noise Control, Inc.
 - b. Vibration isolators for suspended equipment with minimum static deflection requirement exceeding .4", and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable steel spring in series with a molded oil-resistant neoprene insert, complete with load transfer plates and assembled in stamped or welded steel bracket. The spring element shall meet all the specified characteristics described in Section 2.1/E.1 paragraph. The stamped or welded hanger bracket shall meet all the specified characteristics described in Section 2.1/E.7 paragraph. The combination isolation hanger assembly with neoprene inserts shall be **Model SRH**, as manufactured by Kinetics Noise Control, Inc.
 - c. Vibration isolators for suspended equipment with minimum static deflection requirement exceeding .4", and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable steel spring in series with a pre-compressed molded fiberglass insert, complete with load transfer plates and assembled in a stamped or welded steel bracket. The fiberglass insert element shall meet all the specified characteristics described in Section 2.1/6.a paragraph. The spring element shall meet all the specified characteristics described in Section 2.1/E.1 paragraph. The stamped welded hanger bracket shall meet all the specified characteristics described in Section 2.1/E.7 paragraph. The combination isolation hanger assembly with fiberglass inserts shall be **Model SFH**, as manufactured by Kinetics Noise Control, Inc.
6. Neoprene Hangers: Type RH – Vibration isolators with maximum static deflection requirements under the operating load conditions not exceeding .40" shall be hangers consisting of an elastomer-in-shear insert encased in a welded steel bracket and provided with a stamped load transfer cap. The elastomer insert shall be neoprene, molded from oil resistant compounds and shall be color coded to indicate load capacity and selected to operate within its published load range. The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30-degree arc without metal-to-metal contact or other short circuit. Vibration isolation hanger shall be **Model RH**, as manufactured by Kinetics Noise Control, Inc.
7. Vibration Isolation Pads:
- a. Isolation pads shall be neoprene elastomer in-shear pads, used in conjunction with steel shims where required, having static deflections as tabulated. Kinetics RSP neoprene pads are produced from a high quality neoprene elastomer. Pads are 50 durometer and are designed for a maximum of 60 psi (4.2 kg. / sq. cm) loading. Pads are designed for a maximum deflection of approximately 20% of its unloaded thickness, 0.15" (0.38 cm). Several layers of RSP pads can be stacked for additional deflection when steel separation shim stock is used. The elastomer is oil

and water resistant, offers a long life expectancy consistent with neoprene compounds, and has been designed to operate within the safe stress limits of the material. RSP pads are available up to 18" x 18" x 3/4" (457 mm x 457 mm x 19 mm) thick sheets and are pre-scored into 2" x 2" (51 mm x 51 mm) squares and can be easily cut-to-fit as needed. All pads shall be elastomer in-shear and shall be molded using 2500 psi minimum tensile strength, oil resistant neoprene compounds with no color additives. Neoprene vibration isolators shall have minimum operating static deflections as shown on the Vibration Isolation Schedule, or as indicated on the project documents, but not exceeding published load capabilities. Neoprene vibration isolators shall be **Model RSP** as manufactured by Kinetics Noise Control, Inc.

b. Isolation pads shall be single ribbed or crossed, double ribbed elastomer-in-shear pads, in combination with steel shims when required, having minimum static deflections as tabulated. All pads shall be true elastomer-in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI (176 kg/cm²) tensile strength, oil resistant compounds with no color additives. Pads shall be 45 to 65 durometer and designed to permit 60 or 120 PSI (4.2 or 8.4 kg/cm²) loading at maximum rated deflections. When two isolation pads are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate. Neoprene vibration isolators shall have minimum operating static deflections as shown on the Vibration Isolation Schedule or as indicated on the project bid documents, not exceeding published load capabilities. Neoprene vibration isolators shall be **Model NPS, NPD, NGS or NGD**, as manufactured by Kinetics Noise Control, Inc.

c. Fiberglass continuous support material shall be high-density matrix of compressed molded fiberglass; individually coated with a flexible, moisture-impervious elastomeric membrane, designed to allow controlled air movement in the fiber media. It shall be manufactured in such a way that the pumping action of air between fibers provides viscous damping, reducing motion caused by transient shock and vibration. The material is to be non-corrosive, non-combustible, non-absorbent, and resists rust, ozone, mildew and fungus, vermin proof and it will not shrink, swell, or decompose. Isolation characteristics of the media are to be constant over a temperature range of -40°F to 250°F (40°C to 121°C). Fiberglass isolation strips shall be **Model KIP-RT**, as manufactured by Kinetics Noise Control, Inc.

8. Curb-Mounted Spring Rail: Type KSR – Full-perimeter rail type isolator, spring components shall be (1"/25 mm), (2"/51 mm) deflection, free-standing, un-housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for 50% overload to solid. The spring element shall meet all the specified characteristics described in Section 2.01/E.1 paragraph. Springs shall be color coded to indicate load capacity. Rails shall provide continuous support for the rooftop equipment and shall be designed to provide isolation against casing-radiated vibration in the rooftop equipment housing and structure-borne vibration from rotating and mechanical equipment in the rooftop package. Rail assembly shall consist of extruded aluminum top and bottom members connected by spring isolators and a continuous air- and water-tight seal. The seal shall be a beaded elastomeric material retained in a keyway along the top extrusion. The weather strip shall be sealed along the bottom with an aluminum fascia strip. Rail assemblies shall incorporate means for attachment to the building and the supported equipment and shall incorporate additional stiffening members if necessary to assure stability. Rails shall be fitted with wind restraint devices suitable for prevailing wind conditions that will not impose loads on the curb walls at 90 degrees to their long axis. Vibration isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents. Roof Curb Rails shall be **Model KSR** as manufactured by Kinetics Noise Control, Inc.

9. Vibration Restrained Curb-mounted Spring Rail: Type KSCR – All rooftop air-handling units shall be supported by vibration isolation curbs as manufactured by Kinetics Noise Control. The vibration isolation curbs shall be complete assemblies designed to resiliently support the equipment at the specified elevation and shall constitute a fully enclosed air- and weather-tight system. The isolation curb shall consist of an upper support rail with supply and return flexible connector supports on which the equipment and duct openings rest and a lower support curb which is attached to the roof structure, separated by freestanding, un-housed, laterally stable steel springs and lateral seismic and/or wind load restraints. The upper support rail shall provide continuous structural support for the rooftop equipment and shall be designed to provide isolation against casing-radiated vibration in the rooftop equipment housing and structure-borne vibration from rotating and mechanical equipment in the rooftop package. The upper support rail shall consist of an extruded aluminum structural shape with a minimum height of 4.75" (121 mm) above the spring to preclude interference with the rooftop equipment. The upper support rail extrusion shall include a continuous keyway to accommodate the beaded elastomeric weather seal and a channel to maintain proper spring alignment. The lower support curb shall be a formed channel fabricated of heavy gauge galvanized steel with a continuous 1-1/2" x 1-1/2" (38 mm x 38 mm) nominal wood nailer. The base plate of the curb shall be 1" (25 mm) wide and shall be welded, bolted or screwed to the building support steel. The lower support curb shall have a minimum elevation of 14" (356 mm). Spring components shall be 1" (25 mm) 2" (51 mm) deflection, freestanding, un-housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for a typical 50% overload to solid. All springs shall have a polyester powder coated finish and be color coded to indicate load capacity. Springs shall rest on a neoprene noise pad. The spring and noise pad shall be captured in a retainer cap secured to the lower support curb. The lateral stabilizers (pat. pending) shall be stainless steel spring assemblies factory located and installed to provide seismic and/or wind load restraint. Standard units are designed to withstand a 43 psf. horizontal and 25 psf. vertical wind load. Resistance to higher loads or for ratings on extended height curbs or units attached to wood or concrete will require analysis by KNC, but can in most cases be met with only minor modification. The weather seal shall run continuously around the perimeter of the curb and be joined in the field with one seam using a double-faced elastomeric adhesive. The weather seal shall be fastened to the wood nailer of the lower support curb using screws and an aluminum fascia strip. Supply and return flexible connector support hardware shall be supplied for installation by the contractor in the field. The supports will be clearly marked and dimensioned on the submittal and installation drawings. The support hardware shall be cut-to-length galvanized steel channels supported and connected with stamped and punched galvanized steel duct support hangers. The support hangers shall allow the duct support elevation to be equal to or lower than the equipment rail elevation. Supply and return air duct shall be flexibly attached by the contractor to prevent transmission of vibration to the building structure. The isolation curb assembly shall include a troubleshooting kit to permit the contractor to level or adjust the loading of the isolation system immediately after placement of the rooftop equipment should the actual weight and/or distribution differ from design values. Vibration isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents. Roof Curb Rails with an Integral Curb shall be **Model KSCR**, as manufactured by Kinetics Noise Control, Inc.
10. Spring Isolation Roof Curb: Type ESR – Curb type isolator with integral spring isolators, designed to provide a complete roof curb installation. All rooftop air-handling units shall be supported by vibration isolation curbs as manufactured by Kinetics Noise Control. The vibration isolation curbs shall be complete assemblies designed to resiliently support equipment at the specified elevation and shall constitute a fully enclosed air- and weather-tight system. The isolation curb shall consist of an upper support rail with supply and return duct supports on which the equipment and duct openings rest and a lower support curb which is attached to the roof structure, separated by free-standing, un-housed, laterally stable steel springs. The upper support rail shall provide continuous structural support for the rooftop equipment and shall be designed to provide isolation against casing radiated vibration in the rooftop equipment housing and structure borne vibration from rotating and mechanical equipment in the rooftop package. The upper support rail shall consist of a structural channel with sufficient elevation above the spring to preclude interference with the rooftop equipment and permit access to inspect the isolation system after placement of the rooftop equipment. Attachment to of the RTU by weather seal attachment bolt heads is not permitted. The lower support curb shall be a formed channel fabricated of heavy gauge galvanized steel with a continuous 1-1/2 inch x 1-1/2 inch (38 mm x 38 mm) nominal wood nailer attached to the isolation support pedestals. The isolation support pedestal, which

includes the seismic and wind load restraints, shall be bolted or welded to the building support steel to suitably transfer seismic and wind load forces to the building structure. The lower support curb shall have a minimum elevation of 14 inches (356 mm) from the top of the wood nailer to the base of the curb. Spring components shall be (1 inch/25 mm) (2 inch/51 mm) (4 inch/102 mm) deflection, free-standing, un-housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed for a typical 50% overload to solid. All springs shall have a polyester powder coated finish and be color coded to indicate load capacity. Spring coils shall rest on minimum 0.25 inch (6 mm) neoprene noise pads. The isolation curb system shall be complete with cross-bracing as required as a part of the upper and lower assemblies. Supply air and return duct shall be flexibly attached by the contractor to prevent transmission of vibration to the building structure. Airborne noise control packages, if required, shall be supported by the roof structure within the curb and shall have no rigid contact with the isolation curb. Vibration isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents. Roof Curb Rails shall be **Model ESR** as manufactured by Kinetics Noise Control, Inc.

F. Flexible Duct Connectors:

1. Laminated flexible sheet of cotton duck and sheet elastomer (butyl, neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure. Form connectors with full-faced flanges and accordion bellows to perform as flexible isolation unit, and of manufacturer's standard length for each size unless otherwise indicated. Equip each unit with galvanized steel retaining rings for airtight connection with ductwork.

G. Flexible Pipe Connectors:

1. For non-ferrous piping, provide bronze hose covered bronze wire braid with copper tube ends or bronze flanged ends, brazewelded to hose.

PART 3 - INSTALLATION

3.01 GENERAL

- A. Except as otherwise indicated, apply the following types of vibration isolators at indicated locations or for indicated items of equipment. Selection is Installer's option where more than one type is indicated.

1. Neoprene-Pad-Type Isolated:

Install where the following equipment is indicated:

Air compressors.

2. Spring isolators:

Install where the following floor-mounted equipment is indicated:

Air-handling units.

Note: Some Air-handling units may be internally isolated and may not require spring isolators.

3. Isolation Hangers:

Install where the following ceiling-mounted equipment is indicated:

Exhaust Fans
Cabinet Unit Heaters

4. Flexible Duct Connectors:

Install at the following ductwork connections:

Connections with vibration-isolation-mounted air handling equipment, exhaust fans, cabinet unit heaters, etc.

5. Flexible Pipe Connectors:

Install in piping systems at the following locations:

Connections with vibration-isolation-mounted equipment, includes air handling units.

3.02 INSTALLATION

- A. Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.
- B. Bond flanges of flexible duct connectors to ducts and housings to provide airtight connections. Seal seams and penetrations to prevent air leakage.
- C. Install flexible pipe connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts wherever possible.

END OF SECTION

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PART 1 GENERAL

1.01 WORK INCLUDED

- A. Identification of mechanical products installed under Division 230000.

1.02 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

- A. Submit product data under provisions of Section 230000.
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background color.
- C. Metal tags: Brass with stamped letters.
- D. Stencils: With clean cut symbols and letters of the following size:

<u>OUTSIDE DIAMETER OF INSULATION OR PIPE</u>	<u>LENGTH OF COLOR FIELD</u>	<u>SIZE OF LETTERS</u>
3/4" - 1-1/4"	8"	1/2"
1-1/2" - 2"	8"	3/4"
2-1/2" - 6"	12"	1-1/4"
Equipment	---	2-1/2"

- E. Stencil Paint: Semigloss enamel.
- F. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.
- G. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- H. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6" wide by 4 mil. thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Plastic or Metal Nameplates: Install with corrosive-resistant mechanical fasteners, adhesive or corrosive-resistant chain.
- B. Plastic Tape or Plastic Pipe Markers: Install complete around pipe in accordance with manufacturer's instructions.
- C. Equipment: Identify air handling units, pumps, tanks, heat transfer equipment, condensing units, and air

compressors with plastic nameplates. Small devices, such as in-line pumps, may be identified with plastic or metal tags.

- D. Controls: Identify control panels and major control components outside panels with plastic nameplates.
- E. Piping: Identify piping, concealed or exposed, with plastic tape pipe markers or stenciled painting. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.
- F. Underground Plastic Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

3.03 MECHANICAL IDENTIFICATION SCHEDULE

- A. Domestic hot and cold water piping, natural gas piping, heating hot water supply and return piping, chilled water supply and return piping, tanks, air handling units, condensing units, condensers, exhaust fans, return fans, pumps and heat transfer equipment.
- B. Provide valve chart and schedule in frame with glass or clear plastic cover. Install in Mechanical Room.

END OF SECTION

NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS SPECIFICATION IS COPYWRITTEN.

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Owner shall contract with an independent testing, adjusting, and balancing (TAB) agency to test, adjust, and balance the HVAC systems. This contractor shall perform TAB work solely and exclusively as their primary source of business.
- B. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting, and balancing the HVAC and Hydronic systems, as described in these specifications and/or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.
- C. The items requiring testing, adjusting, and balancing are described in detail in section 1.06 and generally include the following:

AIR SYSTEMS:

Air Moving Equipment
Exhaust Fans
Zone Branch and Main Ducts
Diffusers, Registers and Grilles
Energy Recovery Units

HYDRONIC SYSTEMS:

Pumps
System Mains and Branches
Coils

1.02 RELATED SECTIONS

- A. Section 230000 - Mechanical General Provisions.
- B. Section 230500 - Basic Mechanical Materials and Methods.
- C. Section 232119 - Hydronic Piping.
- D. Section 250000 - Building Control System.
- E. Section 255100 - Sequence of Operations

1.03 DEFINITIONS, REFERENCES, STANDARDS

- A. The following is a list of standards that this work shall be performed and submitted in accordance with. It is the responsibility of this contractor to adhere to the more stringent specifications of these different standards to meet the requirements this section.
- B. AABC National Standards for Total System Balance (2002 Edition)
- C. ASHRAE - 1989 Systems Handbook: Chapter 37, Testing, Adjusting and Balancing.
- D. SMACNA B HVAC Systems Testing, Adjusting & Balancing (Third Edition - August, 2002)
- E. TABB-Testing, Adjusting, and Balancing Bureau (Current Edition)
- F. NEBB - Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems (1998, Sixth Edition).

1.04 ALLOWANCES

- A. Installation is included as part of this Section and is to be included in the Contract Sum.

1.05 BALANCING AGENCY QUALIFICATIONS

- A. An impartial, independent Test & Balancing Company will provide the TAB services required for this project. This contractor shall specialize in performing TAB work solely and exclusively as their primary source of business. This Company shall have performed TAB work on projects similar in size and scope and shall be prepared to provide documented proof of such as requested by the engineer, architect and owner.
- B. Agency Qualifications: The TAB Company shall be a current and certified member of a Test & Balance institution that offers comprehensive training and certification of its members or they shall be a TAB company specializing in this type of work with a minimum of 5 years documented work experience. The TABB company shall be prepared to submit records of experience in the field of air and hydronic system balancing or any

other data as requested by the Engineer.

- C. Final Approval: Note that the Owner, Architect, and Engineer shall select and make the FINAL APPROVAL of the TABB Contractor for this project.

Approved Balancing Company:

- 1. Integrity Test & Balance, Inc. 8 Traverse City, MI, Phone-231-929-0940, Fax-231-929-0949
 - 2. Great Lakes Balancing, Grand Rapids, MI, Phone 616-813-7384
 - 3. Alternates to be approved before bid submittal as per spec. 230000.
- D. Procedures and Agenda: The TAB Company shall submit the TAB procedures and agenda proposed to be used.
 - E. Sample Forms: The TAB Company shall submit sample forms, which shall include the minimum data required as set forth in these specifications.
 - F. Provide bound reports with a cover page, letter size, manuals, complete with index page and/or tabs.

1.06 SUBMITTALS

- A. Submit name of independent adjusting and balancing agency for approval, see Specification Section 15000.
- B. Submit test reports as a submittal under provisions of Section 15000.

1.07 TAB PREPARATION AND COORDINATION

- A. It will be necessary for the TABB Company to perform his services in close coordination with the Mechanical Contractor on a critical path network. It is the TABB Companies responsibility to initiate this continuing coordination to determine his schedule for final testing and balancing services and periodic inspections required during construction.
- B. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided by the Mechanical Contractor or General Contractor to the TAB Company no later than 60 days prior to the start of TAB work. This information shall include but not necessarily limited to the following:
 - 1. Project drawings and specification.
 - 2. Approved construction revisions pertaining to the HVAC systems.
 - 3. Approved submittal data on HVAC and Hydronic equipment and systems to be installed by the mechanical contractor.
 - 4. Approved HVAC and Hydronic shop drawings.
 - 5. Approved Temperature Control System wiring diagrams, submittals and system diagrams.

1.08 MECHANICAL CONTRACTOR RESPONSIBILITIES

- A. The Mechanical Contractor shall complete the installation and start-up of all HVAC systems to ensure they are working properly and shall perform all other items as described hereinafter to assist the TABB Company in performing the testing and balancing of the HVAC and Hydronic systems.
- B. Air Distribution Systems:
 - 1. Verify installation for conformity to design, manufacturer guidelines and industry standards.
 - 2. Terminate all exhaust ducts, and pressure test them for leakage, as required by the specifications.
 - 3. Ensure that all volume, splitter, extractor and fire dampers are properly located, functional and open. Volume dampers found to be non-functional or obstructed for proper adjustment shall be repaired/replaced by this mechanical contractor. Dampers serving outside, return, and relief air shall provide for tight closure and full opening, with smooth free operation.
 - 4. All volume damper handles and manual locking quadrants shall be freely visible and exposed for identification and use. These devices found to be covered over by duct installation shall require the

mechanical contractor and/or the insulation contractor to survey **all** of the installed volume dampers and correct such measures at no additional cost to the owner.

5. Verify that all supply, return, exhaust and transfer grilles, registers, diffusers and high pressure terminal units are open and installed for proper operation.
6. Ensure that all HVAC units and associated apparatus, such as heating and cooling coil line penetrations , filter sections, mixing box sections, access doors etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.
7. Ensure that all fans (supply, return, relief and exhaust) are operating and free of vibration and drives packages are checked for proper rotation and belt tension. Overload protection devices shall be of proper sizing and rating as verified by Electrical Contractor and confirmed to the Mechanical Contractor.
8. Make any necessary changes to the fan sheaves, belts, and dampers as required by the TABB Company at no additional cost.
9. Insure that all HVAC units have newly installed and clean air filters prior to commencing with the air balance.

C. Water Circulating Systems@

1. Verify installation for conformity to design, manufacturer guidelines and industry standards.
2. Check all pumps to verify proper pump and motor coupling alignment and rotation.
3. Ensure that systems have been flushed, cleaned, construction strainers removed from pumps and final strainers installed for normal operation. System shall be properly be filled to operating pressure and expansion tanks pressurized accordingly.
4. Check all pump motors for current and voltage to ensure that motors do not exceed manufacturers name plate FLA amperage rating.
5. Overload protection devices shall be of proper sizing and rating as verified by Electrical Contractor and confirmed to the Mechanical Contractor.
6. Check and set operating temperatures of heat exchangers, boilers and fuel fired equipment to manufacturers and design requirements.

1.09 BUILDING CONTROL CONTRACTOR RESPONSIBILITIES

- D. The building control system shall be complete and operational. The Building Control System contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided by the Building Control System contractor as required for reprogramming, coordination, and problem resolution. This should include but not be limited to the following:
1. Making final adjustments for minimum outdoor air on AHU's, RTU's and other pertinent HVAC equipment.
 2. Making final adjustments for variable frequency drives for VAV systems and recording of final static pressure set point.
 3. Making global commands for all heating valves to go open for preparation of proper water balance procedures.
 4. The building controls contractor shall allow sufficient time as necessary in the project to provide the assistance and instruction to the TABB Company in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may require set points changes so that the TABB Company can properly perform the required work.

1.10 REPORTS

- A. Final TAB Report - The TAB Company shall submit the final TAB report for review by the engineer. All outlets, devices, HVAC equipment, etc. shall be identified, along with a numbering system corresponding to report unit identification. The TAB company shall submit an Project Performance Certification and Guaranty, assuring

that the project systems were tested, adjusted, and balanced in accordance with the project specifications. Submit four (4) copies of the report form for final approval.

B. Forms shall include the following information:

1. Title Page
2. Air Moving Equipment:
 - a. Location
 - b. Manufacturer
 - c. Model
 - d. Serial Number
 - e. Air flow, specified and actual
 - f. Return air flow, specified and actual
 - g. Outside air flow, specified and actual
 - h. Total static pressure and external static pressure, specified and actual
 - i. Component (coils, filters, air blenders etc.) static pressure drop, specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Fan and motor RPM, design and actual
 - m. Sheave size, manufacturers model number.
 - n. Belt size, manufacturer and center distance from motor shaft to fan shaft.
3. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model
 - d. Air flow, specified and actual
 - e. Total static pressure (total external), specified and actual
 - f. Inlet pressure
 - g. Discharge pressure
 - h. Fan and motor RPM, design and actual
 - i. Sheave size, manufacturers model number.
 - j. Belt size, manufacturer and center distance from motor shaft to fan shaft.
5. Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design combined air flow
 - c. Actual combined air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
6. Electric Motors:
 - a. Manufacturer
 - b. HP/BHP
 - c. Phase, voltage, amperage; nameplate, actual.
 - d. RPM, nameplate and actual
 - e. Service factor
 - f. Starter size, rating, heater elements
 - g. Motor sheave size, manufacturer number, number of turns open-actual.
7. Duct Traverse:
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design air flow
 - e. Test velocity
 - f. Test air flow
 - g. Duct static pressure
 - h. Air temperature
8. Air Distribution Test Sheet:
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type-manufacturers model number

- d. Terminal size-duct/collar connection size.
 - e. Area factor if flow hood is not used
 - f. Design air flow
 - g. Test (final) velocity/air volume
9. Pump Data
- a. Identification/number
 - b. Manufacturer
 - c. Size/model
 - d. Impeller
 - e. Service
 - f. Design flow rate, pressure drop
 - g. Actual flow rate, pressure drop
 - h. Discharge pressure
 - i. Suction pressure
 - j. Total operating head pressure
 - k. Shut off, discharge and suction pressures
 - l. Shut off, total head pressure-verify impeller size.
10. Hydronic Equipment
- a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Water flow, design and actual
 - g. Water pressure drop, design and actual
 - h. Air pressure drop, design and actual
 - i. Circuit setter manufacturer, size, model number, required pressure drop for design flow rate.
 - j. Circuit setter adjustment setting, final pressure drop and corresponding flow rate.
11. Test Instrument Inventory and Calibration
- a. Test Instrument
 - b. Manufacturer
 - c. Model Number
 - d. Serial Number
 - e. Type-Analog, electric, digital
 - f. Application for testing
 - g. Date of most recent calibration. Note: N.I.S.T certification of calibration will be provided upon request for proof of compliance.

1.11 DEFICIENCIES

- A. Any deficiencies in the installation or performance of a system or component observed by the TAB Company shall be brought to the attention of the construction manager or his on site representative.
- B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB Company returns to retest. Unresolved deficiencies shall be noted in the final report.

PART 2 - EXECUTION

2.01 GENERAL

- A. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting, and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with standards set forth in section 1.03
- B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
- C. All information necessary to complete a proper TAB project and report shall be per the standards in section 1.03, unless otherwise noted. The descriptions for work required, as listed in this section, are a guide to the minimum information needed.

3.02 EXAMINATION

- A. Before commencing work, verify that systems are complete and operable. Ensure the following:
 - 1. Equipment is operable and in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Correct fan rotation.
 - 7. Fire and volume dampers are in place and open.
 - 8. Coil fins have been cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage has been minimized.
 - 12. Hydronic systems have been flushed, filled, and vented.
 - 13. Correct pump rotation.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
- B. Report any defects or deficiencies noted during performance of services to the Engineer.
- C. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.
- D. If, for design reasons, system cannot be properly balanced, report as soon as observed.
- E. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.04 INSTALLATION TOLERANCES

- A. Adjust air handling systems to plus or minus 10 percent for supply systems and plus or minus 10 percent for return and exhaust systems from figures indicated.
- B. Adjust hydronic systems to plus or minus 10 percent of design conditions indicated.

3.05 ADJUSTING

- A. Adjust work under provisions of Section 15000.
- B. Recorded data shall represent actually measured, or observed condition.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has

SECTION 230593

Testing, Adjusting and Balancing

Page 6 of 8

been rectified.

- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 AIR SYSTEM PROCEDURE

A. General:

1. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
2. Make air quantity measurements in ducts by Pitot-tube traverse of entire cross sectional area of duct.
3. Measure air quantities at air inlets and outlets.
4. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
5. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
6. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
7. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
8. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
9. Adjust outside air, return air, and exhaust dampers for design conditions.
10. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
11. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
12. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
13. For variable air volume system powered units, set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
14. On fan powered VAV boxes, adjust air flow switches for proper operation.

B. Specific:

1. The TAB Company shall perform the following TAB procedures in accordance with the following:

For Supply Fans:

- a. Fan Speeds - Test and adjust fan RPM to achieve maximum or design CFM.
- b. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
- c. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM.
- d. Outside Air - Test and adjust the outside air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical, use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees F., or use the difference between Pitot-tube traverses of the supply and return air ducts.
- e. Static Pressure - Test and record system static profile of each supply fan.

For Exhaust Fans:

- a. Fan Speeds - Test and adjust fan RPM to achieve maximum or design CFM.
- b. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
- c. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main exhaust ducts to obtain total CFM.
- e. Static Pressure - Test and record system static profile of each exhaust fan.

For Zone, Branch and Main Ducts:

- a. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

For Diffusers, Registers, and Grilles:

- a. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts.
- b. Identification - Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

For Coils:

- a. Air Temperature - Once air flows are set to acceptable limits, take differential pressure readings across coils and take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry bulb temperature shall be taken on the entering and leaving side of each heating coil.

3.07 WATER SYSTEM PROCEDURE

A. General:

1. Adjust water systems to provide required or design quantities.
2. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
4. Affect system balance with automatic control valves fully open to heat transfer elements.
5. Affect adjustment of water distribution systems by means of balancing cocks, valves and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
6. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

B. Specific:

1. The TAB Company shall perform the following standards:

For Pumps:

- a. Test and adjust chilled water and hot water pumps to achieve maximum or design GPM. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.
- b. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

For System Mains and Branches:

- a. Adjust water flow in pipes to achieve maximum or design GPM.

For Boilers:

- a. Verify that boilers have been filled and started by others, and are in operation.
- b. Test and adjust water flow through water boilers.
- d. Test and record temperature and pressure profiles of water or steam boilers.

For Coils:

- a. Tolerances - Test, adjust, and balance all chilled water and hot water coils within 10% of design requirements.
- b. Verification - Verify the type, location, final pressure drop and GPM of each coil. This information shall be recorded on coil data sheets.

END OF SECTION

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PART 1 - GENERAL

1.01 SCOPE OF WORK

It is the intent of this specification to outline the need for a plan that maintains the quality of the building during the renovation and addition to the building.

1.02 RELATED SECTIONS

- A. Section 230000 - Mechanical General Provisions.
- B. Section 230500 - Basic Mechanical Materials and Methods.
- C. General Construction Specifications.

1.03 REFERENCES, STANDARDS

- A. The following is a list of standards that this work shall be performed and submitted in accordance with. It is the responsibility of this contractor to adhere to the more stringent specifications of these different standards to meet the requirements this section.
- B. IAQ Guidelines for Occupied Buildings Under Construction, Sheet Metal and Air Conditioning Contractors' National Association, Inc., First Edition, 1995.
- C. Good Practice Guidelines for Maintaining Acceptable Indoor Environmental Quality During Construction and Renovation Projects, National Institute for Occupational Safety and Health, 1997.
- D. Mold Remediation in Schools and Commercial Buildings, United States Environmental Protection Agency, 2001.

1.04 INDOOR AIR QUALITY

Goals: The owner has set the following indoor air quality goals for jobsite operations on project, within the limits of the construction schedule, contract sum, and available materials, equipment, products and services. Goals include:

- 1. Schedule renovation work during periods of low building occupancy if possible.
- 2. Isolate work areas from occupied areas using critical barriers, air pressure control and high-efficiency particulate air (HEPA) filtration.
- 3. Minimize the number of building penetrations necessary for entry into the renovation area. Choose the penetration sites carefully to minimize the potential for occupant exposure.
- 4. Modify HVAC operations according to specifications of consulting and IUPUI staff engineers prior to and during renovation activities to ensure isolation of renovation areas from occupied spaces.
- 5. Maintain an adequate unoccupied buffer zone around renovation areas according to design specifications. This may require temporarily relocating building occupants in the immediate vicinity of renovation areas.
- 6. Increase housekeeping activities in adjacent occupied areas during renovation activities that create dust.

1.04 INDOOR AIR QUALITY PLAN

A. Within fourteen (14) days after receipt of Notice of Award and prior to any waste removal by the Contractor from the Project, the Contractor shall develop and submit to the Owner for review a healthy indoor air quality plan. This plan shall be Part II of a "Sustainable Job Site Operations Plan."

- 1. List of IAQ protective measures to be instituted on the site.
- 2. Specify conditions that would require an emergency response, such as asbestos release or a major water loss.
- 3. Employ local exhaust when dust, hazardous vapors, fumes, or gases are generated. If local exhaust is not feasible, portable air cleaning devices (such as the use of HEPA-filtration) may be used.
- 4. Minimize dust generation by using wet methods for cutting or sanding.
- 5. Locate dumpsters for debris away from operating HVAC outdoor air intakes and exterior doors to occupied areas where possible

1.05 SUBSTITUTIONS

- A. Should the Contractor desire to use procedures, materials, equipment, or products that are not specified but meet the intent of these specifications to protect air quality on the site, the Contractor shall propose these substitutions in accordance with Substitutions and "Or Equal" in General Requirements.

PART 2 - MATERIALS

2.01 GENERAL

- A. Low emitting products have been specified in appropriate sections.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor is minimally required to meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995 to:
 - 1. Protect the ventilation system components from contamination, OR provide cleaning of the ventilation components exposed to contamination during construction prior to occupancy.
 - 2. Provide a continuous ventilation rate of one air change per hour minimum during construction, OR, conduct a building flush-out with new filtration media at 100% outside air after construction ends (following issuance of Occupancy Certificate) and prior to occupancy for seven days (one week).
 - 3. Provide a minimum of 85% filtration (as determined by ASHRAE Standard 52.1-1992) on any return air systems operational during construction, and replace filtration media prior to occupancy.
 - 4. Ventilation shall be provided in order to maintain a negative pressure in all areas of occupied buildings where there is potential for dust contaminant generation from a construction project.
 - 5. The contained area shall be kept under negative pressure relative to the surrounding areas by the use of HEPA filtered negative air machine(s). A minimum of -.02 column inches of water pressure differential, relative to outside pressure, shall be maintained within the work area as evidenced by manometer measurements provided by the contractor on a continuous basis.
 - 6. Construction documents shall specify modifications required to existing mechanical systems or temporary equipment to be installed to properly ventilate the affected building areas.
 - 7. Construction documents shall include temporary ductwork layouts (as necessary) as well as sizing and specifications of fans.
 - 8. Contractors shall not make design decisions for temporary ventilation of occupied areas of buildings.
 - 9. Isolate portions of the HVAC system that may become contaminated from renovation activities as specified by consulting and IUPUI staff engineers.
 - 10. Seal return air grilles in renovation areas.
 - 11. Upgrade filtration efficiency in the HVAC systems that continue to be used during renovation (if possible) as directed by specifications.
- B. During installation of carpet, paints, furnishings, and other VOC-emitting products, provide supplemental (spot) ventilation for at least 72 hours after work is completed. Preferred HVAC system operation uses supply air fans and ducts only; exhaust provided through windows. Use exhaust fans to pull exhaust air from deep interior locations. Stair towers and other paths to exterior can be useful during this process.
- C. Conduct regular inspection and maintenance of indoor air quality measures including ventilation system protection, and ventilation rate.
- D. Require VOC-safe masks for workers installing VOC-emitting products (interior and exterior) defined as products that emit 150 gpl or more UNLESS local jurisdiction's requirements (Canadian or US) are stricter, in which case the strictest requirement shall be followed for use of VOC-safe masks.

- E. Use low-toxic cleaning supplies for surfaces, equipment, and worker's personal use. Options include several soybean-based solvents and cleaning options (SoySolv) and citrus-based cleaners.
- F. Use wet sanding for gypsum board assemblies. Exception: Dry sanding allowed subject to owner approval of the following measures:
 - 1.Full isolation of space under finishing
 - 2.Plastic protection sheeting is installed to provide air sealing during the sanding
 - 3.Closure of all air system devices and ductwork
 - 4.Sequencing of construction precludes the possibility of contamination of other spaces with gypsum dust
 - 5.Worker protection is provided
- G. Use safety meetings, signage, and subcontractor agreements to communicate the goals of the indoor air quality construction plan.

3.02 HOUSE KEEPING MEASURES FOR AIR QUALITY ASSURANCE

- A. Identify the route(s) for removing construction debris from the building.
- B. Identify traffic routes for renovation workers within the building, using pathways away from occupied spaces if possible.
- C. Identify specific locations within buildings that contractors may use, including restrooms (if appropriate).
- D. Eliminate demolition/renovation debris by bagging on site and/or the use of covered wheelbarrows or cart to transport debris to containers outside of the building.
- E. Contractors shall clean areas inside of construction exits to minimize dirt and debris from entering occupied spaces in the building.
- F. Contractors shall clean occupied areas adjacent to renovation site (such as hallways) if construction debris or soil has caused an area to be notably dirtier than other similarly occupied areas.
- G. Place walk-off mats at all entrances and exits from the renovation area. These mats must be regularly cleaned or replaced to minimize migration of dust from the project site.

3.03 SPECIFIC CONTROL MEASURES FOR PAINTING OCCUPIED AREAS

- A. Schedule work during evening hours or periods of low building occupancy.
- B. Use low odor/ low VOC products.
- C. Provide EHS copies of Material Safety Data Sheets for all products being used.
- D. Provide ventilation in the area. If necessary, maintain a negative pressure in all areas being painted.

3.04 ROOF LEAKS, PIPE BREAKS AND OTHER WATER LOSSES CAUSED BY RENOVATION

- A. Contractors are responsible for all water losses inside buildings that happen as a result of their renovation activity.
- B. Contractors shall inform Campus Facilities Services of all water losses that occur due to construction activities.
- C. Campus Facilities Services will manage the water remediation process and be reimbursed by contractor for all expenses involved with the remediation.
- D. Only University-approved contractors will be employed for water remediation.
- E. Water must be removed and damaged building materials must be replaced.

3.05 OUTDOOR WORK WITH HAZARDOUS ODOROUS MATERIAL NEAR INTAKES

- A. Locate portable toilets away from air intakes.

- B. Use or application of chemical/odorous materials shall be located at least 25 feet away from all outside air intakes (if feasible).
- C. When work including chemical/odorous materials must be done at or near air intakes, outside air intake should be minimized or the task should be performed when the building is not occupied (such as evenings or weekends).
- D. For long-term projects that use chemicals or produce combustion exhaust near air intakes, install charcoal filters in the air handling units serving the occupied space of the building.

3.06 MEASURES FOR GOOD AIR QUALITY

- A. Discuss air quality issues at regularly-scheduled construction meetings. The contractor indoor air quality representative needs to be included in these meetings.
- B. Monitor renovation activities carefully to ensure that all work conforms to the stated air quality control measures.
- C. Monitor pressurization at renovation areas, using a pressure monitoring device, to ensure that proper isolation and ventilation is in effect.
- D. Monitor for visible or odorous airborne contaminants in adjacent occupied areas.
- E. Promptly respond to occupant complaints in order to resolve issues that involve renovation areas.

3.07 MEASURES FOR ENFORCEMENT OF AIR QUALITY ASSURANCE

- A. Contractors are responsible for meeting all specifications involving maintaining acceptable air quality for building occupants.
- B. Contractors shall coordinate with University Architects Office and Environmental Health and Safety for any variations to the specifications or circumstances outside of their control involving air quality in occupied buildings.
- C. If an acceptable air quality condition is not maintained by contractors, appropriate University officials may halt construction operations until suitable measures have been taken to restore good air quality for building occupants.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Piping insulation, jackets and accessories.
- B. Ductwork insulation, jackets and lining.
- C. Equipment insulation and covering.
- D. Misc. Items

1.02 RELATED WORK

- A. Section 230500 - BASIC MECHANICAL MATERIALS AND METHODS.
- B. Section 232500 - HYDRONIC PIPING
- C. Section 233100 - DUCTING

1.03 QUALITY ASSURANCE

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Insulation materials shall be 100% asbestos free.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 230000.
- B. Include product description, list of materials and thickness for each service or equipment scheduled, and locations. Provide manufacturer=s installation instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Owens Corning, Manville, Armstrong, Certain Teed, Knauf or substitutions under provisions of Section 15000.

2.02 MATERIALS

- A. Type A: Fiberglass pipe insulation equal to Owens Corning Fiberglass ASJ/SSL-II Pipe Insulation with a "k" value of 0.25 @ 75 F, ASTM C547, Class 1, including vapor barrier.

Vapor Retarder Jacket: White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or jacket with outward clinch expanding staples coated with vapor barrier mastic as needed.

- B. Type B: Closed-Cell, Elastomeric foam rubber insulation equal to Armstrong AP Armaflex . (Pipe and/or sheet insulation in accordance with ASTM C-534; with a AK@ value not to exceed .27 @ 75 F), max flame spread 25, max smoke developed 50.
- C. Type C: Rigid board duct, class 1, insulation equal to Owens Corning type 703 with a maximum thermal conductivity of .22 @ 75 F, and FRK vapor barrier facing, ASTM C612, Class 1.
- D. Type D: Flexible duct insulation equal to Owens Corning all service duct wrap type 150 with a maximum thermal conductivity of .27 @ 75 F, and FRK vapor barrier facing ASTM C553, Type 1, Class B-4.
- E. Type E: Acoustical duct liner equal to Owens Corning Aeroflex duct liner type 150 with a maximum thermal conductivity of .28 @ 75 F. Ductwork dimensions indicated are inside dimensions required for air flow. For applications involving indoor air quality concerns, use Armstrong=s self-adhering, non-fibrous, Armaflex duct liner (3/4" thick).
- F. Type F: Rigid foam glass with Pit wrap.
 - 1-1/2" thickness up to 2" pipe dia.
 - 2" thickness above 2" pipe dia.
- G. Type G: Semi-rigid fiberglass board insulation, factory jacketed with a laminated Kraft aluminum foil All Service Jacket (ASJ) vapor barrier. Maximum thermal conductivity of 0.27 @ 75° F. Insulation shall be

equal to Owens Corning pipe and tank insulation.

- H. Type H. Icynene ProSeal™ (MD-C-200v3) Spray Foam Insulation: Medium-density, HFC 365/227 blown, conforming to the following:
1. Thermal Resistance (for 1 inch of material) (R-Value/inch @75 deg F): ASTM C 518; 7.1 hr.sq ft.degree F/BTU
 2. Air Permeance (for 1 inch of material): ASTM E 2178: less than 0.02 L/s.m² @75 Pa
 3. Water Vapor Transmission (for 1.5 inches of material): ASTM E 96; 0.97 perm
 4. Resistance to Fungal Growth: ASTM C 1338: no growth
- Product Emissions: Collaborative for High Performance Schools (CHPS) "Low-emitting" material per CA Section 01350 criteria
- I. Field Applied Jackets
1. PVC Plastic: One piece molded type fitting covers and jacketing material, gloss white.
 - a. Connections: Tacks, pressure sensitive color matching vinyl tape.
 2. Canvas Jacket: UL Listed fabric, 6 oz./sq. yd., plain weave cotton treated with dilute fire retardant lagging adhesive.
 3. Aluminum Jacket: 0.016 inch thick sheet finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory applied moisture barrier.
 4. Stainless Steel Jacket: Type 304 stainless steel, 0.010 inch.
 5. Exterior Spray on Coating shall be equal to OR80SLM Pure Polyurea as manufactured by Coatings Holdings LTD, 575 Commercial Ave., Green Lake, WI 54941
- I. Hydrous Calcium Silicate meeting ASTM C 533, Type I; rigid molded pipe; asbestos-free color coded throughout material thickness.
1. >K= Value: 0.42 at 300 ° F Mean Temperature as tested in accordance with ASTM C 335.
 2. Maximum Service Temperature: 1200 ° F.
 3. Non-combustible as determined by test following ASTM E 136.
 4. Tie Wire: 16 gage stainless steel with twisted ends on maximum 12 inch centers.
- J. Type G: Semi-rigid fiberglass board insulation, factory jacketed with a laminated Kraft aluminum foil All Service Jacket (ASJ) vapor barrier. Maximum thermal conductivity of 0.27 @ 75° F.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install materials after piping or ductwork has been tested and approved. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions, building codes and industry standards.
- B. Continue insulation with vapor barrier through penetrations.
- C. Exterior insulated piping shall be jacketed with .016" aluminum jacket, banded on 18" centers and sealed watertight with mastic. Sealing not required if Type B insulation (elastomeric foam) is installed per manufacturer=s instructions (entire insulation system is air/water tight, vapor barrier).
- D. All fittings and valves shall be insulated with corresponding pipe insulation. Domestic hot water line valves, mechanized fittings and joints (i.e., unions, etc.) may be uninsulated if they are concealed in walls or above ceilings.
- E. Unions and flanges on insulated cold water piping shall be insulated, but on other systems shall not be insulated. Terminate insulation neatly at each side of union and/or flange with insulating cement, so unions and flanges may be taken apart without disturbing insulation.
- F. Rigid board insulation shall be impaled over Mechanical fasteners, (SMACNA fastener standard), on 12 in. x 18 in. centers. Use a minimum of two rows of fasteners per side.

- G. Flexible insulation shall be firmly adhered to ducts with full coverage of fire retardant adhesive. For flexible insulation on ducts 24 inches or more in width, use both adhesive and mechanical fasteners on the bottom of the duct to prevent possible sagging. Mechanical fasteners and spacing shall be as specified for rigid board insulation.
- H. Acoustical duct liner shall be adhered to the sheet metal with 100% coverage of adhesive, and all exposed leading edges and all transverse joints coated with adhesive. Duct liner shall also be secured using mechanical fasteners which shall compress the liner sufficiently to hold it firmly in place.
- I. Cover exterior insulated rectangular ducts with .016" thick aluminum jacket secured watertight with mechanical fasteners, bands or screws.
- J. Cover exterior insulated round ducts with .016" thick aluminum jacket with moisture barrier.

3.03 INSULATION SCHEDULE

<u>SERVICE</u>	<u>SIZE</u>	<u>INSULATION TYPE & THICKNESS</u>
HEATING HOT WATER	UP THRU 1-1/2"	TYPE A, 1" or TYPE B, 3/4"
HEATING HOT WATER	OVER 1-1/2"	TYPE A, 1-1/2" or TYPE B, 1"
DOMESTIC HOT WATER	UP THRU 1-1/2"	TYPE A, 1" or TYPE B, 1/2"
DOMESTIC HOT WATER	OVER 1-1/2"	TYPE A, 1-1/2" or TYPE B, 3/4"
DOMESTIC COLD WATER	ALL SIZES	TYPE A, 1" or TYPE B, 1/2"
STORM	ALL SIZES	TYPE A, 1" or TYPE B, 1/2"
ROOF DRAINS	ALL SIZES	TYPE A, 1" or TYPE B, 1/2"
REFRIG. LINES	THRU 4"	TYPE B, LINE TEMP +10EF or LOWER - 1"; LINE TEMP +10EF or HIGHER - 3/4"
CONDENSATE PIPING	ALL SIZES	TYPE A, 1" OR TYPE B, 3/4"
ALL ROUND OUTSIDE AIR (MAKE-UP & COMBUSTION) & RELIEF AIR DUCTS	ALL SIZES	TYPE D, 2" or TYPE B, 3/4"
ALL RECTANGULAR OUTSIDE AIR (MAKE-UP & COMBUSTION) & RELIEF AIR DUCTS	ALL SIZES	TYPE C, 1-1/2" or TYPE B, 3/4"
EXHAUST AIR DUCTS WITHIN 10' OF OUTSIDE TERMINATION	ALL SIZES	TYPE D, 2", or TYPE B, 3/4"
SUPPLY AIR DUCTS	ALL SIZES	TYPE D, 2", or TYPE B, 3/4"
ACOUSTICALLY LINED ROUND DUCTS		SEE SPECIFICATION SECTION 15890 OR
SUPPLY AND RETURN AIR DUCTS (ASSOCIATED WITH HEATING/COOLING EQUIP.) WITHIN 10' OF MECHANICAL EQUIPMENT OR AS SHOWN ON PLANS	ALL SIZES	TYPE E, 1", OR TYPE B, 3/4" (Armstrong=s self-adhering, non-fibrous, Armaflex duct liner)

ALL DUCTWORK EXPOSED TO OUTDOOR AIR TEMPERATURES (i.e. ATTIC OR SOFFIT INSTALLATIONS)	ALL SIZES	TYPE D, 2" or Type B, 1 1/2"
<u>SERVICE</u>	<u>SIZE</u>	<u>INSULATION TYPE & THICKNESS</u>
ALL DUCTWORK EXPOSED TO OUTDOOR (i.e. ROOF MOUNTED INSTALLATIONS)	ALL SIZES	TYPE H, 2", Reference 3.02.I.5 Polyurea covering
EXHAUST DUCTWORK 10' LENGTH AHEAD OF FAN (UPSTREAM) SPIRAL DUCTWORK TO 10' FROM UNIT DISCHARGE	ALL SIZES	TYPE E, 1" OR TYPE B, 3/4" (Armstrong=s self-adhering, DOUBLE WALLED PERORATED EQUAL TO UNITED MCGILL ACOUSTI-K27
WATER STORAGE TANKS & THERMAL BUFFER TANKS	ALL SIZES	TYPE G, 2" THICK

END OF SECTION

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PART 1 GENERAL

1.01 WORK INCLUDED

- A. Pipe and pipe fittings.
- B. Valves.
- C. Heating water piping system.
- D. Heat Pump piping system.

1.02 RELATED WORK

- A. Section 230500 - Basic Mechanical Materials and Methods
- B. Section 230700 - Thermal Insulation

1.03 REGULATORY REQUIREMENTS

- A. Conform to the latest revision of ANSI/ASME B31.9.
- B. Boiler external piping shall comply with the latest revision of Section I of the ASME Boiler & Pressure Vessel Code.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 230000. Include data on pipe materials, pipe fittings, valves, and accessories.
- B. Submit a copy of the standard welding procedure specification together with the procedure qualification record as required by Section IX of the ASME B & PV Code.
- C. Include welders certification of compliance with ANSI/ASME SEC 9.

PART 2 PRODUCTS

2.01 HEATING & CHILLED WATER PIPING

<u>ITEM</u>	<u>TYPE JOINT</u>	<u>SIZE</u>	<u>CLASS</u>	<u>MATERIAL</u>
TUBING	95-5 TIN Antimony	UP THRU 2"	TYPE L	ASTM B88/HARD DRAWN
FITTINGS	95-5 TIN Antimony	UP THRU 2"	TYPE L	ANSI B16.29 WROUGHT COPPER
UNIONS		UP THRU 2"	300 LB.	BRONZE TO BRONZE SEAT
PIPE	WELD/Grooved	2 1/2" & UP	SCH.40	ASTM A53/SEAMLESS
FITTINGS	WELD/Grooved	2 1/2" & UP	STANDARD	ASTM A234/ANSI B16.9
FLANGES		2 1/2" & UP	150 LB.	ANSI B16.5

B. PEX (crossed linked polyethylene)

1. Tube shall be cross-linked polyethylene, with maximum working pressure/temperature of 160 psi @ 73.4EF, 100 psi @ 180EF, 80 psi @ 200EF. These temperatures and pressure ratings shall be issued by hydrostatic stress board of PPI (Plastic Pipe Institute). PPI is a division of SPI (Society of Plastics Industry).
2. The tube shall be manufactured in accordance with ASTM standard specification F 876, as manufactured by Uponor Company, Thawpak, or Heat Link. The tube shall be listed to ASTM by independent third party testing laboratory. 1.

2.02 GROOVED PIPING: Heating & Chilled.

- A. **Pipe:** Schedule 10 ASTM A-120 with factory supplied roll grooves that meet grooved coupling manufacturer's latest specification. All field roll grooves must be measured with a pi-tape and meet specification prior to coupling assembly. **Note:** This assembly method is important and joints will be randomly field checked by the engineer.
- B. **Gaskets:** Gaskets must be Grade "E" with a Flushseal center leg design as provided by Victaulic Company of America or engineer approved equal. All product submittals must be approved prior to bidding. All gaskets must be lubricated with a non-petroleum based lubricant compatible with the grooved coupling manufacturer's gasket. Approved grooved coupling manufacturers: **Victaulic only.**
- C. **Fittings:** All grooved fittings must be domestic and of one manufacturer. All grooved fittings must be manufactured of ASTM A-536 Ductile Iron. Approved grooved fittings manufacturers are **Victaulic Company of America.**
- D. **Couplings:** All grooved couplings must be domestic and of one manufacturer. All couplings shall be Zero-Flex "rigid" design. All couplings must be installed as per the manufacturer's latest recommendations. Provide all necessary anchors, supports and restraints per the manufacturer's recommendations for all grooved pipe systems. Three (3) flexible grooved Style 77 or 75 couplings may be used at all pumps in lieu of flex connectors.
- E. **Grooved Valves:**
 - 1. All grooved butterfly and check valves must be of one domestic manufacturer and shall be rated to 300 PSI. All grooved valves shall have an internal and external PPS coating and the disc liner must be consistent with that of the grooved coupling gasket and be compatible for the service. All grooved butterfly valves must have a blowout proof stem. The disc and stem must be of a one piece ductile iron construction.
 - 2. Butterfly Valves 2" - 6" must have a 10 position lever lock handle and valves above 6" must have a gear operator.
 - 3. Tour & Anderson circuit balancing valves series 787 threaded, series 786 solder end & 789 grooved end arc are approved for heating services.
- F. **Straining Devices:** Victaulic S/730 Tee strainer & 731 Suction Diffuser are approved for heating services.

2.03 GATE VALVES

- A. Crane, Stockham, Powell, Conbraco or substitutions under provisions of Section 230000.
- B. Up to 2 Inches: Bronze body, bronze trim and wedge, rising stem, and threaded ends.
- C. Over 2 Inches: Cast iron body, bronze trim, rising stem, O.S. & Y., and flanged ends.

2.04 GLOBE VALVES

- A. Crane, Stockham, Powell, Conbraco or substitutions under provisions of Section 230000.
- B. Up to 2 Inches: Bronze body and disc, rising stem and handwheel, renewable composition disc, repackable under pressure and screwed ends.
- C. Over 2 Inches: Cast iron body, bronze trim, rising stem, handwheel, O.S. & Y., plug-type disc, flanged ends, renewable seat and disc.

2.05 BALL VALVES

- A. Crane, Stockham, Apollo or substitutions under provisions of Section 230000.
- B. Up to 2 Inches: Bronze body, stainless steel ball, Teflon seats, and stuffing box ring and threaded ends.

2.06 BUTTERFLY VALVES

- A. Crane, Stockham, Conbraco or substitutions under provisions of Section 230000.
- B. Iron body, bronze disc, resilient replaceable seat for service to 250 degrees F, wafer or lug ends, extended neck, 10 position lever handle.

2.07 SWING CHECK VALVES

- A. Crane, Stockham, Conbraco or substitutions under provisions of Section 230000.

- B. Up to 2 inches: Bronze 45 degree swing disc, solder ends.
- C. Over 2 inches: Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

2.08 SPRING LOADED CHECK VALVES

- A. Crane, Stockham, Conbraco or substitutions under provisions of Section 230000.
- B. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer or flanged ends.

2.09 RELIEF VALVES

- A. Crane, Stockham, Conbraco or substitutions under provisions of Section 230000.
- B. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 EXECUTION

3.01 PREPARATION

- A. Before proceeding with fabrication / installation of piping, inspect the contract documents and determine that the location of work does not interfere with other work. In case of interference, notify the Engineer.

3.02 INSTALLATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Prepare piping connections to equipment with flanges or unions.
- B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations. Install valves with stems upright or horizontal, not inverted.
- C. Install piping to conserve building space, and not interfere with use of space and other work.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- E. Provide clearance for installation of insulation, and access to valves and fittings. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with other trades.
- F. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Prepare pipe, fittings, supports, and accessories for finish painting.

3.03 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Provide 3/4 inch ball drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- F. Use butterfly valves in heating, water systems interchangeably with gate and globe valves.
- G. Use only butterfly valves in chilled water systems for throttling and isolation service.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Low pressure ducts.
- B. Duct cleaning.

1.02 RELATED WORK

- A. Section 230529 - Supports and Anchors: Sleeves.
- B. Section 230700 - Thermal Insulation.
- C. Section 230593 - Testing, Adjusting and Balancing.

1.03 REFERENCES

- A. ASHRAE - Handbook 1989 Fundamentals; Duct Design.
- B. ASHRAE - Handbook 1988 Equipment; Duct Construction.
- C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- D. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- E. SMACNA - Low Pressure Duct Construction Standards.
- F. SMACNA - High Pressure Duct Construction Standards.
- G. UL 181 - Factory-Made Air Ducts and Connectors.
- H. Fibrous glass duct construction standards.

1.04 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Low Pressure: Three pressure classifications: 1/2 inch WG positive or negative static pressure and velocities less than 2,000 fpm; 1 inch WG positive or negative static pressure and velocities less than 2,500 fpm and 2 inch WG positive or negative static pressure and velocities less than 2,500 fpm.

1.05 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 (if applicable) standards.

1.06 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 230000.
- B. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for low and medium pressure and kitchen hood exhaust systems.
- C. Submit manufacturer's installation instructions for glass fiber ducts under provisions of Section 230000.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.
- B. Steel Rectangular Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per square feet for each side in conformance with ASTM A90.
- C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F.

- D. Round Spiral Ducts: ASTM A-527-71, galvanized steel, spiral locking seam equal to United McGill Uni-Seal.
- E. Internal Insulated Round Spiral Ducts: ASTM A-527-71, galvanized steel, spiral locking seam equal to United McGill Uni-Rib k-27.
- F. Fibrous Glass Ducts: UL 181; 1-1/2 inch thick rigid glass fiber with aluminum foil, glass scrim and kraft or plastic jacket vapor barrier; maximum 0.23 K value at 75 degrees F.
- G. Stainless Steel Ducts: ASTM A167, type 304.

2.02 LOW PRESSURE DUCTWORK

- A. Fabricate and support in accordance with SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- E. Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.
- F. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- H. Use double nuts and lock washers on threaded rod supports.

2.03 MEDIUM AND HIGH PRESSURE DUCTS

- A. Fabricate and support in accordance with SMACNA High Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.
- C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
- D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.04 FIBROUS GLASS DUCTS (May only be bid as a Voluntary Alternate)

- A. Fabricate and install in accordance with SMACNA Fibrous Glass Duct Construction Standards, except as indicated.
- B. Machine fabricate fibrous glass ducts and fittings. Make only minor on site manual adjustments.
- C. Staple duct joints and tape with 3 inch wide 2 mil thick or 2 inch wide 3 mil thick aluminum pressure sensitive tape, UL approved 2 inch wide pressure sensitive tape, UL approved 3 inch wide heat activated chemical bonding tape.

- D. Do not use fibrous glass ducts within 12 inches of electric or fuel fired heaters.

PART 3 - EXECUTION

3.01 PREPARATION/INSTALLATION

- A. Before proceeding with fabrication and installation of ductwork, inspect the contract documents and determine that the location of work does not interfere with other work. In case of interference, notify the Engineer.
- B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- D. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum length of flexible duct in areas where a ceiling is installed. Hold in place with strap or clamp.
- E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- F. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for all ductwork. Ductwork installation is to meet Michigan Health Department Regulations.

3.02 DUCTWORK APPLICATION SCHEDULE

AIR SYSTEM

MATERIAL

Low Pressure Supply	Rectangular or spiral round as indicated on drawings.
Return and Relief	Rectangular or spiral round as indicated on drawings.
Toilet Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Acoustically Lined Supply	Internally insulated as indicated.

3.03 ADJUSTING AND CLEANING (Only required if contractor fails to keep clean.)

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

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PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Filters.
- B. Spare Media & Filters.

1.02 RELATED WORK

- A. Section 230000 – MECHANICAL GENERAL PROVISIONS

1.03 QUALITY ASSURANCE

- A. Unless otherwise specified, all filter efficiencies shall be based on the ASHRAE Standard 52-76 test on atmospheric dust.
- B. Filter unit and media shall be fabricated from basic raw materials by the same manufacturer.

1.04 INDOOR AIR QUALITY ASSURANCE

- A. The filtration requirements shall be as specified and shown on the plans and shall be in strict accordance with ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality.
- B. The successful bidder shall include with their submittals documentation that the equipment submitted will meet or exceed the design requirements in these specifications and ASHRAE 62-1989.
- C. Documentation shall include, but not limited to, mathematical calculations that demonstrate the filtration devices submitted will meet the requirements of ASHRAE 62-1989's method of designing for acceptable indoor air quality.
- D. Documentation shall include allowances for ventilation effectiveness, outdoor air quality, minimum ventilation rate during occupancy, and the systems affect on respirable particulate and targeted volatile organic compounds.
- E. The particulate and gas phase filtration system specified is in strict compliance with ASHRAE standard 62-1989. Any deviation from the basis of design must be submitted along with all above listed documentation two weeks prior to bid date.
- F. The successful bidder shall include in their submittals, the manufacturer's signed letter of assurance of equipment conformance with ASHRAE standard 62-1989 as related to performance.

1.05 SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Refer to Section 230000 - Mechanical General Provisions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. The air filter design has been based on Farr filters.

2.02 MIXING BOX & FLAT FILTERS

- A. Air Filters shall be medium efficiency, pleated, disposable type. Each filter shall consist of a cotton and synthetic fabric media, media support grid, and enclosing frame. The filter shall be listed as Underwriters' Laboratories Class 1.
- B. 2" & 4" Depth as required:

The Filter shall have no less than 4.6 square feet of media per square foot of filter face area and no less than 15 pleats per linear foot of filter face area. A 96% open area media support grid of 25 gauge welded wire construction, coated with rust inhibitor, shall be bonded to the air exiting side of the filter.

The enclosing frame shall be high wet-strength beverage board with diagonal support members bonded to the air entering and air exiting side of each pleat. The inside periphery of the enclosing

frame shall be bonded to the filter pack.

- C. The Filter shall have an average efficiency of 25-30%, and an average arrestance of 90.2% in accordance with ASHRAE Standard 52.1-1992. The minimum MERV when tested under ASHRAE 52.2 shall be no less than 8. Initial resistance at 500 feet per minute approach velocity shall not exceed 0.30".
- D. Filters are based on Farr.
- E. Supply filters for all air moving equipment per manufacturers recommendation.

PART 3 - EXECUTION

3.01 SPARE MEDIA AND FILTERS

- A. In the original installation of filters, provide filter media. On completion of the work, furnish and deliver to the Owner, spare media and filters equal to the complete replacement of the mixing box and flat filters provided in the original installation.
 - 1. Filter unit and media shall be fabricated from basic raw materials by the same manufacturer.
 - 2. Each media carton to bear a code number certifying that the following tests have been carried out by the manufacturer: ASHRAE Standards Test 52-68, AFI Performance Test, Test for Uniformity of Resistance, Media Compressibility and Strength Test, Weight Test for Quantity of Fiber. Laboratory proof of performance will be required.

3.02 INDOOR AIR QUALITY(IAQ) MANAGEMENT PLAN FOR CONSTRUCTION AND PRE-OCCUPANCY

- A. If the air handling units are used during construction, filtration media with a minimum Efficiency Reporting Value (MERV) of 13 must be used at each return air grille, as determined by ASHRAE 52.2-1999.
- B. During construction procedures must meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3.
- C. Protect stored on-site or installed absorptive materials from moisture damage.
- D. Replace all Filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2.-1999 for media installed at the end of construction.
- E. If the air handling units are not used during construction all terminations (SA, RA, and EA) shall be covered as to not allow contaminates from entering.

END OF SECTION

NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS SPECIFICATION IS COPYWRITTEN.

Part 1: GENERAL

1.00 WORK PROPOSAL

THE BID FOR BUILDING CONTROLS SHALL BE TO THE E.C. The controls contractor shall coordinate directly with both the 23 and 26 trades to complete a fully operable system.

Work contained within this specification shall be limited to the installation of the owner purchased controls. This work shall be focused on installing infrastructure to facilitate the programming and commissioning of the controls.

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 230500– Basic Mechanical Materials and Methods
 - 1. Control Valves
 - 2. Flow Switches
 - 3. Temperature Sensor Wells and Sockets
 - 4. Flowmeters
 - 5. VFD Motor drives

1.02 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

- A. Section 230500 – Basic Mechanical Materials and Methods
 - 1. Discharge Air Temperature Control
 - 2. Economizer Control
 - 3. Volume Control

1.03 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of this specification and shall be used in conjunction with this section as a part of the contract documents. Consult them for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 0 and Division 1.
- B. The following sections constitute related work:
 - 1. SECTION 230000 – GENERAL MECHANICAL PROVISIONS
 - 2. SECTION 230500 - BASIC MECHANICAL MATERIAL METHODS
 - 3. SECTION 230593 – TESTING, ADJUSTING AND BALANCE
 - 4. SECTION 260000 – GENERAL ELECTRICAL PROVISIONS
 - 5. SECTION 260500 – BASIC ELECTRICAL MATERIAL AND METHODS

1.04 DESCRIPTION

- A. General: The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and operator workstation(s) residing and communicating on a BACnet IP (Internet Protocol) network. The operator workstation(s) shall be a personal computer (PC) with a color monitor, mouse, keyboard, and printer. The PC will allow a user to interface with the network via multi-tasking dynamic color graphics. Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics. A modem shall be provided for remote access to the network. Systems using gateways to route proprietary devices and objects to BACnet are not acceptable.
- B. For Local Area Network installations provide access to the control system via the Internet. The owner shall provide a connection to the Internet via high-speed cable modem, ADSL, ISDN, T1 or through the facility ISP. The owner shall pay for all monthly Internet access fees and connection charges.
- C. The control system shall be supplied with a complete web enabled package. The system shall support unlimited users using standard web browsers such as Internet Explorer and Netscape. The web server software shall operate on standard industry PC servers. Proprietary servers or "black boxes" are not acceptable. Web browser software shall be manufactured by the control system manufacturer and shall have the same look and feel as the operating system. Third party web software is not acceptable.
- D. The system will provide for future expansion to include monitoring of the card access, fire alarm, and lighting control systems.

1.05 APPROVED CONTROL SYSTEM MANUFACTURERS

- A. System shall be **Reliable Controls**.

1.06 QUALITY ASSURANCE

- A. Contractor/Manufacturer Qualifications
1. The Installer shall have an established working relationship with the Control System Manufacturer, and be the authorized representative of the Manufacturer at bid time.
 2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
 3. All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be available for at least 5 years after completion of this contract.

1.07 CODES AND STANDARDS

- A. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
1. National Electric Code (NEC)
 2. Uniform Building Code (UBC)
 - a) Section 608, Shutoff for Smoke Control
 - b) Section 403.3, Smoke Detection Group B Office Buildings and Group R, Division 1 Occupancies
 - c) Section 710.5, Wiring in Plenums
 - d) Section 713.10, Smoke Dampers
 - e) Section 1106 Refrigeration Machinery Rooms
 - f) Section 1107, Refrigeration Machinery Room Ventilation
 - g) Section 1108, Refrigeration Machinery Room Equipment and Controls
 - h) Section 1120, Detection and Alarm Systems
 3. MICHIGAN MECH. CODE 2009
 4. ASHRAE 135-2007
 5. FCC Regulation, Part 15- Governing Frequency Electromagnetic Interference
 6. Underwriters Laboratories UL916

1.08 SYSTEM PERFORMANCE

- A. Performance Standards. The system shall conform to the following:
1. Graphic Display. The system shall display a graphic with 20 dynamic points/objects with all current data within 10 seconds.
 2. Graphic Refresh. The system shall update a graphic with 20 dynamic points/objects with all current data within 8 seconds
 3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be less than 2 seconds. Analog objects should start to adjust within 2 seconds
 4. Object Scan. All changes of state and change of analog values will be transmitted over the high-speed Ethernet network such that any data used or displayed at a controller or workstation will have been current within the previous 2 seconds
 5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds

1.09 WARRANTY

- A. Warrant all work as follows:
1. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The

Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.

2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period
3. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Engineer, the Engineer shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.
4. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above mentioned items also can be provided during the warranty period for an additional charge to the Owner by purchasing an in-warranty technical support agreement from the Contractor. Written authorization by the Owner must, however, be granted prior to the installation of any of the above-mentioned items.
5. Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labor and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Engineer's acceptance.

Part 2: PRODUCTS

2.0 SECTION INCLUDES

1. Materials
2. Communication
3. Operator Workstation
4. Controller Software
5. Building Controllers
6. Advanced Application Controllers
7. Application Specific Controllers
8. Input/ Output Interface
9. Power Supplies and Line Filtering
10. Auxiliary Control Devices
11. Wiring and Raceways

2.01 MATERIALS

- A. All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

2.02 COMMUNICATION

- A. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2001, BACnet.
- B. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device as defined in this section.
- C. The Contractor shall provide all communication media, connectors, repeaters, bridges, hubs, switches, and routers necessary for the internetwork.
- D. All controllers shall have a communication port for connections with the Operator Workstations using the BACnet Data Link/ Physical layer protocol.
- E. A device on the internetwork shall be provided with a 56k-baud modem that will allow for remote Operator Workstation using the BACnet PTP Data Link/ Physical layer protocol. Remote Operator Workstation via this modem shall allow for communication with any and all controllers on this network as described in Paragraph F below.
- F. Communication services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:

1. Connection of an Operator Workstation device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.
 2. All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.
- G. The time clocks in all controllers shall be automatically synchronized daily. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the network.
- H. The network shall have the following minimum capacity for future expansion:
1. Each Building Controller shall have routing capacity for 99 controllers.
 2. The Building Controller network shall have capacity for 1000 Building Controllers.
 3. The system shall have an overall capacity for 12,500 Building Controller, Advanced Application Controller, and Application Specific Controller input/output objects.

2.03 OPERATOR WORKSTATION

- A. Operator Workstation. Furnish software installation on a **PC Based Owner supplied computer**. The workstation shall be able to access all information in the system. The workstation shall reside on the same Ethernet protocol network as the Building Controllers.
- B. Workstation information access shall use the BACnet protocol. Communication shall use the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol.
- C. Minimum Hardware. The operator workstation and custom programming workstation shall consist of the following:
1. Personal Computer. Furnish IBM compatible PCs as shown. The CPU shall be a minimum of an Intel Pentium and operate at a minimum of 4.0 GHz. A minimum of 32 GB of RAM, one CD drive and a 1TB solid state hard Drive. A two-button mouse also will be provided. Furnish all required serial, parallel, and network communication ports, and all cables for proper system operation. The PC shall have a minimum of a 32" LED monitor.
 2. BACnet Interoperability Building Blocks.
- D. System Software
1. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications that operate under Microsoft Windows.
 2. System Graphics. The operator workstation software shall be a graphical user interface (GUI). The system shall allow display of up to 10 dynamic and animated graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
 3. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Visio or AutoCad
 4. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program. Graphics shall be created by drag-and-drop selection of graphic symbols and drag-and-link with BACnet objects with dynamic and interactive display fields.

5. Multilingual. Software shall be supported in the following languages English, Spanish, French, German, Chinese.
 6. Dynamic Data Exchange (DDE). Software shall support dynamic data sharing with other Windows-based programs for third party add-on functionality e.g. preventative maintenance, tenant billing, etc.
- E. System Applications. Each workstation shall provide operator interface and off-line storage of system information. Provide the following applications at each workstation:
1. System Database Save and Restore. Each workstation shall store on the hard disk a copy of the current database of each Building Controller. This database shall be updated whenever an operator initiates a save command.
 2. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to save the database from any system panel. The operator shall be able to clear a panel database via the network and may initiate a download of a specified database to any panel in the system from the network.
 3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection.
 4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On- line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
 5. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the functions accessible to viewing and/or changing each system application.
 6. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers.
 7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, alarm limit differentials, states, and reactions for each object in the system.
 8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm, in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying upon acronyms or other mnemonics.
 9. Alarm Reactions. The operator shall be able to determine (by object) what if any actions are to be taken during an alarm. Actions shall include logging, printing, starting programs, displaying messages, dialing out to remote stations, paging, providing audible annunciation.
 10. Trend Logs. The operator shall be able to define a custom trend log for any data object in the system. This definition shall include change-of-value digital, change-of-value analog, time interval, start time, and stop time. Trend data shall be sampled and stored on the Building Controller panel, and be archivable on the hard disk and be retrievable for use in spreadsheets and standard database programs.
 11. Alarm and Event Log. The operator shall be able to view all system alarms and change of states from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and clear alarms.
 12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object and property in the system. The status shall be available by menu, on graphics, or through custom programs.
 13. Clock Synchronization. The real-time clocks in all building control panels and workstations shall be using the BACnet Time Synchronization service. The system also shall be able to automatically synchronize all system clocks daily from any operator-designated device in the system. The system shall automatically adjust for daylight savings and standard time, if applicable.

- F. Workstation Applications Editors. Each PC workstation shall support editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at one or more of the controller panels.
1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and setpoints for all controllers.
 2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and month. This shall consist of a monthly calendar for each schedule. Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. The start and stop times for each object shall be adjustable from this master schedule.
 3. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The programming language shall have the following features:
 - a. The language shall be English language oriented, be based on the syntax of BASIC, FORTRAN, C, or PASCAL, and allow for free-form programming (i.e., not column-oriented or "fill in the blanks").
 - b. A full-screen character editor/programming environment shall be provided. The editor shall be cursor/mouse-driven and allow the user to insert, add, modify, and delete custom programming code. It also shall incorporate word processing features such as cut/paste and find/replace.
 - c. The programming language shall allow independently executing program modules to be developed. Each module shall be able to independently enable and disable other modules.
 - d. The editor/programming environment shall have a debugging/simulation capability that allows the user to step through the program and observe any intermediate values and/or results. The debugger also shall provide error messages for syntax and execution errors.
 - e. The programming language shall support conditional statements (IF/THEN/ELSE/ELSE-IF) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
 - f. The programming language shall support floating point arithmetic using the following operators: +, -, /, x, square root, and x-to-the-y-power. The following mathematical functions also shall be provided: natural log, log, trigonometric functions (sine, cosine, etc.), absolute value, and minimum/maximum value from a list of values.
 - g. The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time variables shall be able to be reset by the language so that interval-timing functions can be stopped and started within a program. Values from all of the above variables shall be readable by the language so that they can be used in a program for such purposes as IF/THEN comparisons, calculations, etc.
 - h. The language shall be able to read the values of the variables and use them in programming statement logic, comparisons, and calculations.
 - i. The programs shall support online changes with the ability to read real time values without exiting the program. Sample programs and syntax help functions shall be resident in the program.

G. REPORT MANAGEMENT

1. The following reporting capability shall be provided at the operator workstation.
2. Reporting:
 - a. Internal reports built into operator workstation software
 - b. External reporting via ODBC
3. Internal Reports
 - a. User definable query reports (support advanced multiple property, multiple object).
 - b. Reports shall be scheduled for automatic generation by schedule or event.
 - c. Manual execution to printing/file.
 - d. Ability to save report in system report folder.
 - e. Query controller hierarchy.
 - f. Report to multiple destinations
 - i. Email
 - ii. Print
 - iii. File (text, csv, xml)
 - iv. Terminal

4. Enterprise Interface
 - a. ODBC driver supporting common SQL statements (select, update, insert, where, order by, group by, etc.)
 - b. Allow integration to Enterprise software
 - c. Shall be capable of being used with third party software that supports ODBC connection such as: Microsoft Access, Excel, Crystal Reports, etc.
 - d. All queries shall be real time into live controller network.
 - e. Shall be able to both read and write using SQL.

H. SERVER FUNCTIONS AND HARDWARE

1. A central server, located in the store managers office shall be provided. The server shall support all Network Area Controllers connected to the customer's network whether local or remote. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.
2. The server shall provide scheduling for all Area Controllers and their underlying field control devices.
3. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
4. The server shall provide central management of alarm data for all Network Area controllers supported by the server inclusive of the following:
 - a. View and acknowledge alarms
6. Server Hardware Requirements: The server hardware platform shall have the following requirements:
 - a. The computer shall be an Intel Pentium P4 based computer (minimum processing speed of 1.3 GHz with 128 MB RAM and a 10-gigabyte minimum hard drive). It shall include a 32x CD Rom Drive, 3.5" floppy drive, 2 10/100 Ethernet cards, 1024x768 True Color Video Card
 - b. The server operating system shall be Microsoft Windows 2000 Professional or Microsoft Windows Server.

2.04 **CONTROLLER SOFTWARE**

- A. Furnish the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation
- B. System Security
 1. User access shall be secured using individual security passwords and user names.
 2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
 3. User Log On/Log Off attempts shall be recorded.
- C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each schedule shall consist of the following:
 1. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop and optimal start. Each schedule may consist of up to 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.
 2. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
- D. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions.

- E. Remote Communication. The system shall have the ability to dial out in the event of an alarm using BACnet Point-To-Point at a minimum of 56K baud. Receivers shall be BACnet workstations.
- F. Maintenance Management. The system shall monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.
- G. Sequencing. Provide application software to properly sequence the start and stop of chillers, boilers, and pumps to minimize energy usage in the facility.
- H. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and PID gains shall be user-selectable.
- I. Staggered Start. This application shall prevent all controlled equipment from simultaneously restarting after a power outage.
- J. Energy Calculations. Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s [GPM]) to be accumulated and converted to energy usage data. Provide an algorithm that calculates a sliding-window kW demand value.
- K. Anti-Short Cycling. All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.
- L. On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and setpoint. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.
- M. Run-time Totalization. Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

2.05 BUILDING CONTROLLERS

- A. General. Provide an adequate number of Building Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements.
 1. The Energy Management and Control System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section.
 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 3. Data shall be shared between networked Building Controllers.
 4. The operating system of the Building Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.
 5. Controllers that perform scheduling shall have a real-time clock.
 6. The Building Controller shall support the following BACnet Interoperability Building Blocks (BIBBs):

Data Sharing	Alarm & Event	Scheduling	Trending	Device & Network Mgmt.
DS-RP-A,B	AE-N-B	SCHED-B	T-VMT-B	DM-DDB-A,B
DS-RPM-A,B	AE-ACK-B		T-ATR-B	DM-DOB-A,B
DS-WP-A,B	AE-ASUM-B			DM-DCC-B
DS-WPM-B	AE-ESUM-B			DM-TS-B
DS-COVU-A,B				DM-UTC-B
				DM-RD-B
				DM-BR-B
				NM-CE-A

B. Communication

1. Each Building Controller shall support direct Ethernet or a communications card. The communications card shall be connected to the Building Controller by an PC-104 bus connection. The Building Controller shall be connected to the BACnet network using the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol.
2. Each Building Controller with a communications card shall perform BACnet routing if connected to a network of Custom Application and Application Specific Controllers.
3. The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol P-T-P for connection to a hand-held workstation/ and/or modem.
4. The Building Controller secondary communication network shall support BACnet MS/TP.

C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 40°C [32°F to 100°F] and 10 to 90% RH.
2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

D. Building Controllers shall be fully peer to peer.

E. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field- removable, modular terminal strips — or to a termination card connected by a ribbon cable.

F. Memory. The Building Controller shall have as a minimum standard SRAM of 256 KB, standard DRAM of 1MB and standard non-volatile 1 MB of flash memory in lieu of EPROM. Memory shall be user extendible through RAM chip sockets and SIMMs for future memory expansion.

G. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. The Building Controller shall maintain all database information including BIOS and programming information in the event of a power loss for at least 72 hours. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

H. Inputs/Outputs.

1. Inputs. Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC- voltage, 4-20 mA- current and thermistor-resistive signal types on an individual basis for connecting any status or sensing device. Analog resolution shall be 10-bit A to D.
2. Outputs. Controller input/output board shall support plug-and-play I/O modules or built in HOA modules configured with manual-auto-off override switch, potentiometer and input channel for feedback status or and unrelated analog or digital input. Output supported shall be 0-10 VDC. All HOA's shall be supervised.
3. Diagnostics. Controller input/output board shall have red LEDs providing input status indication.
4. External Power. Controller input/output board shall have one on-board 24 VDC terminal for directly connected active transducers.
5. Building Controller shall have the capability to create, delete and support the following BACnet Objects:
 - a. ANALOG INPUT, ANALOG OUTPUT AND ANALOG VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; COV Increment; Out of Service and Units. In addition, these objects shall support the properties: Device type; Reliability; Min./Max. Values; Update Interval and Resolution.
 - b. BINARY INPUT, BINARY OUTPUT AND BINARY VALUE: These objects shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Default Value; Min On/Off and Out of Service. In addition, these objects shall support the properties: Device Type; Reliability;

- Active/Inactive Texts; Update Interval; Resolution; Change-of-State Time; Count Times and Time Reset.
- c. CALENDAR: This object shall have the following writeable properties: Object Name; Object Value; Description; and Date List.
- d. DEVICE: This object shall have the following writeable properties: Object Name; Description; Location; and UTC Offset.
- e. EVENT ENROLMENT: This object shall have the following writeable properties: Object Name; Object Value; Description; Out-of-Service; Event & Notify Types; Parameters; Property Ref; Enable; and Notification Class.
- f. FILE: This object shall have the following writeable properties: Object Name; Description; File Type; and File Access.
- g. LOOP (PID): This object shall have the following writeable properties: Object Name; Object Value; Description; Polarity; Output and Input Refs.; Input Value & Units; Setpoint Value; PID Values; Bias; Write Priority and COV Increment. In addition, this object shall support the properties: Reliability; Update Interval; Proportional Constant & Units; Derivative Constant & Units.
- h. NOTIFICATION CLASS: This object shall have the following writeable properties: Object Name; Object Value; Description; Priority and Ack Required.
- i. PROGRAM: This object shall have the following writeable properties: Object Name; Object Value and Description. In addition, this object shall support the property Reliability.
- j. SCHEDULE: This object shall have the following writeable properties: Object Name; Object Value and Description; Effective period; Schedule; Exception; Controlled Properties and Write Properties.
- k. TREND LOG: This object shall have the following writeable properties: Object Name; Description; Log Enable; Start/stop Times; Log Device Object Property; Log Interval; Stop When Full; Buffer Size; and Record Count.

2.06 APPLICATION SPECIFIC CONTROLLERS

- A. General. Application Specific Controllers (ASCs) are microprocessor-based DDC controllers which through hardware or firmware design are able to control a wide variety of equipment. They are fully user-programmable, and are not restricted to any one type of equipment.
 - 1. Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network
 - 2. Each ASC will contain sufficient I/O capacity to control the target system.
 - 3. Both firmware and controller database shall be loadable over the network
 - 4. Application Specific Controllers shall be fully peer to peer
 - 5. ASC's shall come with an integrated housing to allow for easy mounting and protection of the circuit board. Only wiring terminals shall be exposed.
 - 6. Application Specific Controllers shall support the following BACnet Interoperability Building Blocks (BIBBs):

Data Sharing	Alarm & Event	Scheduling	Trending	Device & Network Mgmt.
DS-RP-B				DM-DDB-B
DS-WP-B				DM-DOB-B
				DM-DCC-B

B. Communication

- 1. The controller shall reside on a BACnet network using the MS/TP Data Link/ Physical layer protocol.

2. Each controller shall have a BACnet Data Link/ Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network.
 3. Each controller shall have a secondary subnetwork for communicating sensors or I/O expansion modules
- C. Environment. The hardware shall be suitable for the anticipated ambient conditions.
1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°C to 65°C [-40°F to 150°F] and/or suitably installed in a heated or fan cooled enclosure
 2. Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].
- D. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.
- E. Memory. The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.
- F. Immunity to power and noise. ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m [3 ft].
- G. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.
- H. Input/Output. ASC shall support as a minimum, directly connected, a combination of analog outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The Operator Workstations installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.08 INPUT/OUTPUT INTERFERENCE

- A. Hardwired inputs and output points/objects may be wired into the system through Building, Custom Application, or Application Specific Controllers.
- B. All input and output points shall be protected such that shorting of the point to itself, to another point, or to ground, will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 volts of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Digital inputs shall allow the monitoring of ON/OFF signals from remote devices. The digital inputs shall provide a current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Digital inputs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
- D. Analog inputs shall allow the monitoring of 0-5 VDC, 0-10 VDC-voltage, 4-20 mA-current, or thermistors. Analog inputs shall be compatible, and be field configurable to commonly available sensing devices.
- E. Digital outputs shall provide for ON/OFF operation. Digital outputs on Building and Advanced Application Controllers shall have three-position override switches, Hand-Off-Auto with status lights. Outputs shall be selectable for either normally open or normally closed operation.
- F. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide a 0 to 10 VDC signal as required to provide proper control of the output device. Analog outputs on Building or Advanced Application Controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

- G. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation, etc.)
- H. Input/Output points/objects shall be universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point/object with appropriate properties. Application Specific Controllers are exempted from this requirement.
- I. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The Operator Workstations installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.09 POWER SUPPLIES AND LINE FILTERING

- A. Control transformers shall be UL Listed. Furnish Class 2 current-limiting type, or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Limit connected loads to 80% of rated capacity.
 - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection, and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.
 - a. Unit shall operate between 0°C and 50°C [32°F and 120°F]. EM/RF shall meet FCC Class B and VDE 0871 for Class B, and MIL-STD 810C for shock and vibration.
 - b. Line voltage units shall be UL Recognized and CSA Approved.
- B. Power line filtering.
 - 1. Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:
 - a. dielectric strength of 1,000 volts minimum
 - b. response time of 10 nanoseconds or less
 - c. transverse mode noise attenuation of 65 dB or greater
 - d. common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

2.10 AUXILIARY CONTROL DEVICES

- A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:
 - 1. Control dampers shall be parallel or opposed blade type as below or as scheduled on drawings.
 - a. Outdoor and/or return air mixing dampers and face and bypass (F&BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.
 - b. Other modulating dampers shall be opposed blade type.
 - c. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
 - 2. Damper frames shall be 13 gauge galvanized steel channel or 1/8" extruded aluminium with reinforced corner bracing.
 - 3. Damper blades shall not exceed 20 cm [8"] in width or 125 cm [48"] in length. Blades are to be suitable for medium velocity performance (10 m/s [2,000 fpm]). Blades shall be not less than 16 gauge.
 - 4. Damper shaft bearings shall be as recommended by manufacturer for application, Oilite or better.
 - 5. All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 50 L/s·m² [10 cfm per sq. ft.] at 1000 Pa [4" w.c.] differential pressure. Provide air foil blades suitable for a wide-open face velocity of 7.5 m/s [1,500 fpm].

6. Individual damper sections shall not be larger than 125 cm x 150 cm [48" x 60"]. Provide a minimum of one damper actuator per section.
 7. Modulating dampers shall provide a linear flow characteristic where possible.
 8. Dampers shall have exposed linkages.
- B. Electric damper/valve actuators.
1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
 2. Where shown, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing.
 3. All rotary spring-return actuators shall be capable of both clockwise or counter-clockwise spring-return operation. Linear actuators shall spring-return to the retracted position.
 4. Proportional actuators shall accept a 0 to 10 VDC or 2 to 10vdc operating range.
 5. All 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications. Actuators operating on 120 VAC or 230 VAC shall not require more than 11 VA.
 6. All non-spring-return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 N·m [60 in-lb] torque capacity shall have a manual crank for this purpose.
 7. Actuators shall be provided with a raceway fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections
 8. Actuators shall be UL Standard 873 Listed and CSA Class 4813 02 Certified as meeting correct safety requirements and recognized industry standards.
 9. Actuators shall be designed for a minimum of 60,000 full-stroke cycles at the actuator's rated torque.
- C. Control valves.
1. Control valves shall be two-way or three-way type for two-position or modulating service as shown.
 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Water Valves:
 - i. Two-way: 150% of total system (pump) head.
 - ii. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - b. Steam Valves: 150% of operating (inlet) pressure.
 3. Water Valves:
 - a. Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - b. Sizing Criteria:
 - i. Two-position service: Line size.
 - ii. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35kPa [5 psi], whichever is greater
 - iii. Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 35 kPa [5 psi] maximum.
 - iv. Valves ½" through 2" shall be bronze body or cast brass ANSI Class 250, spring-loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.

- v. 2½" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
- c. Water valves shall fail normally open or closed as scheduled on plans, or as follows:
 - i. Water zone valves - normally open {preferred}.
 - ii. Heating coils in air handlers - normally open
 - iii. Chilled water control valves - normally closed.
 - iv. Other applications - as scheduled or as required by sequences of operation.
- 4 Steam Valves:
- a. Body and trim materials shall be per manufacturer's recommendations for design conditions and service. Linear ports for modulating service.
 - b. Sizing Criteria:
 - i. Two-position service: pressure drop 10% to 20% of inlet psig.
 - ii. Modulating service: 100 kPa [15 psig] or less: pressure drop 80% of inlet psig.
 - iii. Modulating service: 101 to 350 kPa [16 to 50 psig]: pressure drop 50% of inlet psig.
 - iv. Modulating service: over 350 kPa [50 psig]: pressure drop as scheduled on plans
- D. Binary Temperature Devices
- 1 Low-voltage space thermostat shall be 24 V, bimetal-operated, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C [55°F to 85°F] setpoint range, 1°C [2°F] maximum differential, and vented ABS plastic cover.
 - 2 Line-voltage space thermostat shall be bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C [55°F to 85°F] setpoint range, 1°C [2°F] maximum differential, and vented ABS plastic cover.
 - 3 Low-limit thermostats. Low-limit thermostats shall be vapor pressure type with an element 6 m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any 30 cm [1 ft] section. The low-limit thermostat shall be manual reset only and be supplied as DPST.
- E. Temperature sensors.
- 1. Temperature sensors shall be thermistors.
 - 2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 1.5 m [5 feet] in length.
 - 3. Immersion sensors shall be provided with a separable brass well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
 - 4. Space sensors shall be equipped with the following:
 - a. programmable buttons for setpoint adjustment and override
 - b. 3-value, 96-segment LCD display
- F. Humidity sensors.
- 1. Duct and room sensors shall have a sensing range of 20% to 80%.
 - 2. Duct sensors shall be provided with a sampling chamber.
 - 3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient conditions of -40°C to 75°C [-40°F to 170°F].
 - 4. Humidity sensor's drift shall not exceed 3% of full scale per year.

G. Flow switches.

1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
2. Paddle type switches (water service only) shall be UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 enclosure unless otherwise specified.
3. Differential pressure type switches (air or water service) shall be UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as specified.

H. Relays.

1. Control relays shall be UL Listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application
2. Time delay relays shall be UL Listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable $\pm 200\%$ (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

I. Override timers.

1. Override timers shall be spring-wound line voltage UL Listed, contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified; suitable for flush mounting on control panel face, located on local control panels or where shown.

J. Current transmitters

1. AC current transmitters shall be self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 0 – 5vdc two-wire output. Unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A full scale, internal zero and span adjustment, and $\pm 1\%$ full scale accuracy at 500 ohm maximum burden
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation.

K. Current transformers

1. AC current transformers shall be UL/CSA recognized and completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full scale output.
3. Transformers shall be split-core type for installation on new or existing wiring,

L. Voltage transmitters

1. AC voltage transmitters shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with $\pm 1\%$ full-scale accuracy with 500 ohm maximum burden.
3. Transmitters shall be UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

M. Voltage transformers.

1. AC voltage transformers shall be UL/CSA recognized, 600 VAC rated, complete with built-in fuse protection.

2. Transformers shall be suitable for ambient temperatures of 4 to 55°C [40 to 130°F] and shall provide $\pm 0.5\%$ accuracy at 24 VAC and a 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

N. Power monitors.

1. Power monitors shall be three-phase type furnished with three-phase disconnect/shorting switch assembly, UL Listed voltage transformers and UL Listed split-core current transformers
2. Shall provide a selectable rate pulse output for kWh reading and a 1 –5vdc or 4 to 20 mA output for kW reading. Shall operate with 5 A current inputs with a maximum error of $\pm 2\%$ at 1.0 power factor or $\pm 2.5\%$ at 0.5 power factor.

O. Current switches

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

P. Pressure transducers

1. Transducer shall have linear output signal. Zero and span shall be field-adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage
3. Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Transducer shall be complete with 1 - 5vdc or 4 to 20 mA output, required mounting brackets, and block and bleed valves.
4. Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 1 - 5vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.

Q. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

R. Pressure-Electric (PE) Switches

1. Shall be metal or neoprene diaphragm actuated, operating pressure rated 0–175 kPa [0–25 psig], with calibrated scale setpoint range of 14–125 kPa [2–18 psig] minimum, UL listed
2. Provide one- or two-stage switch action SPDT, DPST, or DPDT, as required by application.
3. Shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified
4. Shall have a permanent indicating gauge on each pneumatic signal line to PE switches.

S. Electro-pneumatic (E/P) transducers

1. Electronic/pneumatic transducer shall provide a proportional 20 to 100 kPa [3 to 15 psig] output signal from a 0 to 10 VDC analog control input.

T. Local control panels

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with [hinged door], key-lock latch, removable sub-panels. A single key shall be common to all field panels and sub-panels

2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings
3. Provide 120v receptacle at each local panel location.

2.11 WIRING AND RACEWAYS

- A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 16.
- B. All insulated wire to be copper conductors, UL labeled for 90C minimum service.

PART 3: EXECUTION

3.0 SECTION INCLUDES

1. Examination
2. Protection
3. Coordination
4. General Workmanship
5. Field Quality Control
6. Existing Equipment
7. Wiring
8. Communication Wiring
9. Fiber Optic Cable
10. Control Air Tubing
11. Installation of Sensors
12. Flow Switch Installation
13. Actuators
14. Warning Labels
15. Identification of Hardware and Wiring
16. Controllers
17. Programming
18. Control System Checkout and Testing
19. Control System Demonstration and Acceptance
20. Cleaning
21. Training
22. Sequences of Operation

3.01 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started
- B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started
- C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.02 PROTECTION

- A. The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused

- B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects

3.03 COORDINATION

- A. Site
 - 1. Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge
 - 2. Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.
- B. Submittals. Refer to the "Submittals" Article in Part 1 of this specification for requirements
- C. Test and Balance
 - 1. The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes
 - 2. The Contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours
 - 3. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
 - 4. The tools used during the test and balance process will be returned at the completion of the testing and balancing
- D. Life Safety
 - 1. Duct smoke detectors required for air handler shutdown are supplied and installed under Division 16. The Division 16 Contractor shall interlock smoke detectors to air handlers for shutdown as described in Part 3: "Sequences of Operation".
 - 2. Smoke dampers and actuators required for duct smoke isolation are provided under another Division 15 Section
 - 3. Fire/smoke dampers and actuators required for fire rated walls are provided under another Division 15 Section. Control of these dampers shall be by Division 16.
- E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:
 - 1. All communication media and equipment shall be provided as specified in Part 2: "Communication" of this specification.
 - 2. Each supplier of controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
 - 3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions of this specification.

3.04 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment
- C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).
- D. All wiring shall be verified for its integrity to ensure continuity and freedom from shorts and grounds
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.05 FIELD QUALITY CONTROL

- A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship
- C. Contractor shall have work inspected by local and/or state/provincial authorities having jurisdiction over the work

3.07 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes and Division 16 of this specification. Where the requirements of this section differ with those in Division 16, the requirements of this section shall take precedence
- B. All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway per NEC and Division 16 requirement
- C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
- D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations including ceiling return air plenum, approved cables not in raceway may be used, provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenum shall be UL Listed specifically for that purpose.
- E. All wiring in mechanical, electrical, or service rooms — or where subject to mechanical damage — shall be installed in raceway at levels below 3m [10ft].
- F. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- G. Do not install wiring in raceway containing tubing
- H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it, and *neatly* tied at 2m [6ft] intervals
- I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems
- J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals

- L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.
- M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points/objects
- N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations
- O. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and NEC requirements, except as noted elsewhere.
- P. Include one pull string in each raceway 2.5 cm [1"] or larger
- Q. Use coded conductors throughout with different colored conductors
- R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- S. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15cm [6"] from high-temperature equipment (e.g., steam pipes or flues).
- T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- U. Adhere to Division 16 requirements where raceway crosses building expansion joints
- V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.
- W. The Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site
- X. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 1 m [3 ft] in length and shall be supported at each end. Flexible metal raceway less than ½ " electrical trade size shall not be used. In areas exposed to moisture — including chiller and boiler rooms — liquid-tight, flexible metal raceways shall be used.
- Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed

3.08 COMMUNICATION WIRING

- A. The Contractor shall adhere to the items listed in the "Wiring" Article in Part 3 of the specification
- B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring
- D. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.
- E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions

- G. All runs of communication wiring shall be unspliced length when that length is commercially available
- H. All communication wiring shall be labelled to indicate origination and destination data.
- I. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding

3.10 INSTALLATION OF SENSORS

- A. Install all sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing
- D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings
- E. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across duct. Each bend shall be supported with a capillary clip
- F. Low limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m of sensing element for each 1 m² [1 ft of sensing element for each 1 ft²] of coil area
- G. All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.
- H. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.
- I. Differential air static pressure
 - 1. Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable), or to the location of the duct high-pressure tap and leave open to the plenum.
 - 2. Return Duct Static Pressure: Pipe the low-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor
 - 3. Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover at the specified location
 - 4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer
 - 5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment
 - 6. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

3.11 FLOW SWITCH INSTALLATION

- A. Use correct paddle for pipe diameter.

- B. Adjust flow switch in accordance with manufacturer's instructions

3.12 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
 - 1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage
 - 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - 3. Provide all mounting hardware and linkages for actuator installation.
- B. Electric/Electronic
 - 1. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations
 - 2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.14 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labelled at each end within 5 cm [2"] of termination with the DDC address or termination number.
- B. All pneumatic tubing shall be labeled at each end within 5 cm [2"] of termination with a descriptive identifier.
- C. Permanently label or code each point/object of field terminal strips to show the instrument or item served.
- D. Identify control panels with minimum 1 cm [½"] letters on laminated plastic nameplates.
- E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- F. Identify room sensors relating to terminal box or valves with nameplates.
- G. Manufacturers' nameplates
- H. Identifiers shall match record documents

3.15 CONTROLLERS

- A. Provide a separate controller for each AHU or other HVAC system. Combining systems to one controller shall only be done with the engineers approval.
- B. Building Controllers and Advanced Application Controllers shall be selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.
 - 1. Future use of spare capacity shall require providing the field device, field wiring, point/object database definition, and custom software. No additional controller boards or point/object modules shall be required to implement use of these spare points

3.16 PROGRAMMING

- A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 25% of available memory free for future use.
- B. Point/object Naming: System point/object names shall be modular in design, allowing easy operator interface without the use of a written point/object index. Use the following naming convention:

AAABBBCCDDDEEE where:

AAA is used to designate the location of the point/object within the building such as mechanical room, wing, or level, or the building itself in a multi-building environment.

BBB is used to designate the mechanical system with which the point/object is associated (e.g., A01, HTG, CLG, LTG).

CCC represents the equipment or material referenced (e.g., SAF for supply air fan , EXF for exhaust fan, RAF for return air fan).

D or DD or DDD may be used for clarification or for identification if more than one of CCC exists (e.g., SAF10, EXF121).

EEE represents the action or state of the equipment or medium (e.g., T for temperature, RH for humidity, CO for control, S for status, D for damper control, I for current).

C. Software Programming

- 1. Provide programming for the system and adhere to the sequences of operation provided. The Contractor also shall provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
 - a. Text-based:
 - i. must provide actions for all possible situations
 - ii. must be modular and structured
 - iii. must be commented
 - b. Graphic-based
 - i. must provide actions for all possible situations
 - ii. must be documented
 - c. Parameter-based
 - i. must provide actions for all possible situations
 - ii. must be documented

D. Operator Interface

- 1 Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints
- 2 Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point/object show
- 3 The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all Operator Workstation software and their functions as described in this section. This includes any operating system software, the Operator Workstation database, and any third-party software installation and integration required for successful operation of the operator interface

3.17 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Start-up Testing: All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of the system demonstration.

1. The Contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification
2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight
3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations
4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct
5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel
6. Verify that the system operation adheres to the Sequences of Operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimum Start/Stop routines.
7. Alarms and Interlocks
 - a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm
 - b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
 - c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

3.18 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Demonstration
 1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests
 2. The tests described in this section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, startup, and debugging process and as specified in the "Control System Checkout and Testing" Article in Part 3 of this specification. The Engineer will be present to observe and review these tests. The Engineer shall be notified at least 10 days in advance of the start of the testing procedures.
 3. The demonstration process shall follow that approved in Part 1: "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration
 4. The Contractor shall provide at least two persons equipped with two-way communication, and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point/object and system. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.
 5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
 6. Demonstrate compliance with Part 1: "System Performance"
 7. Demonstrate compliance with Sequences of Operation through all modes of operation
 8. Demonstrate complete operation of Operator Workstation

9. Additionally, the following items shall be demonstrated:

- a) DDC Loop Response. The Contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
- b) Demand limiting. The Contractor shall supply a trend data output showing the action of the demand-limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting setpoint, and the status of shed-able equipment outputs.
- c) Optimum Start/Stop. The Contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas
- d) Interface to the building fire alarm system
- e) Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Architect/Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.
- f) Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance

1. All tests described in this specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of Completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1: "Submittals."

3.19 CLEANING

1. The Contractor shall clean up all debris resulting from its activities daily. The Contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
2. At the completion of work in any area, the Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
3. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.20 TRAINING

A. General

1. Provide a minimum of one onsite training class 8 hours in length during the construction period for personnel designated by the owner.
2. Provide two additional training sessions at 6 and 12 months following building's turnover. Each session shall be 8 hrs in length and must be coordinated with the building Owner.

B. Train the designated staff of Owner's Representative and Owner to enable Day-to-day Operators to:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand DDC system components.
4. Understand system operation, including DDC system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log on and off the system.

7. Access graphics, point/object reports, and logs.
 8. Adjust and change system setpoints, time schedules, and holiday schedules.
 9. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.
 10. Understand system drawings, and Operation and Maintenance manual.
 11. Understand the job layout and location of control components.
 12. Access data from DDC controllers and ASC.
 13. Operate portable operator's terminals.
- C. Train the designated staff of Owner's Representative and Owner to enable Advanced Operators to:
1. Make and change graphics on the workstation
 2. Create, delete, and modify alarms, including annunciation and routing of these
 3. Create, delete, and modify point/object trend logs, and graph or print these
 4. Create, delete, and modify reports
 5. Add, remove, and modify system's physical points/objects
 6. Create, modify, and delete programming
 7. Add panels when required
 8. Add Operator Workstation stations
 9. Create, delete, and modify system displays — both graphical and otherwise
 10. Perform DDC system field checkout procedures
 11. Perform DDC controller unit operation and maintenance procedures
 12. Perform workstation and peripheral operation and maintenance procedures
 13. Perform DDC system diagnostic procedures
 14. Configure hardware including PC boards, switches, communication, and I/O points/objects
 15. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
 16. Adjust, calibrate, and replace system components
- D. Train the designated staff of Owner's Representative and Owner to enable System Managers/Administrators to:
1. Maintain software and prepare backups
 2. Interface with job-specific, third-party operator software
- Add new users and understand password security procedures
- E. Provide course outline and materials as per "Submittals" Article in Part 1 of this specification. The instructor(s) shall provide one copy of training material per student.
- F. The instructor(s) shall be factory-trained instructors experienced in presenting this material.
- G. Classroom training shall be done using a network of working controllers representative of the installed hardware.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Heating water loops
- B. Heating Circulating Pumps.
- C. Roof Top units.
- D. Energy Recovery Units.
- E. Exhaust fans.
- F. Cabinet Unit Heaters
- G. Boilers
- G. Heat Pump units.

1.02 SYSTEM DESCRIPTION

- A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections or must be provided as required to meet Sequence of Operation.

1.03 RELATED SECTIONS

- A. Section 230000 MECHANICAL GENERAL PROVISIONS
- B. Section 230500 BASIC MECHANICAL MATERIALS AND METHODS
- C. Section 230593 TESTING, ADJUSTING AND BALANCING
- D. Section 250000 DIRECT DIGITAL CONTROL SYSTEMS

1.04 SUBMITTALS

- A. Submit under provisions of Section 230000.
- B. Submit diagrams indicating mechanical system controlled and control system components. Label with settings, adjustable range of control and limits. Include written description of control sequence.
- C. Include flow diagrams for each control system, graphically depicting control logic.
- D. Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Section 230000.
- B. Accurately record actual setpoints and settings of controls, including changes to sequences made after submission of shop drawings.

PART 2 - PRODUCTS

2.01 TEMPERATURE CONTROL COMPONENT

- A. Temperature controls contractor shall provide all necessary system components (i.e. thermostats, valves, dampers, actuators, transformers, relays, control wiring and tubing, etc.) for a complete operable system.

PART 3 – EXECUTION

3.01 VAV RTU UNITS (RTU- 100-500)

- A. VAV Air Handling Unit - (RTU- 100-500) 0-100% motorized outside air damper and economizer, as controlled by an occupancy sensor. Staged DX cooling controlled by a discharge air sensor, with variable air flow. The space set point as controlled by sensor and lighting occupancy sensors.
 - 1. Occupied Cycle:

- a. The supply fan shall run continuously. A VFD shall modulate the supply fan to maintain an air pressure which allows proper operation of the VAV boxes. Cooling shall be staged to maintain proper coil temperatures. A control valve shall be modulated to maintain a constant discharge temperature. The temperature shall be reset to meet the building seasonal demands. The outdoor air damper shall open to its occupied minimum position. A Carbon Dioxide sensor shall monitor the CO2 level.
- b. The exhaust air fan in conjunction with the return and O.A. dampers shall modulate to maintain proper building pressure.
- c. A photoelectric or ionization type duct smoke detector with manual reset shall be installed and located in the supply air of all units with an air flow of 2000 CFM or greater. The Mechanical Contractor shall wire the detector to stop the supply fan and close the outside air damper when smoke is detected. The detector shall be wired to the fire alarm system by the Electrical Contractor.
- d. A low temperature safety capillary type thermostat with 17' element located on the leaving side of the heating coil which shall stop the fan, fully open the heating valve, and close the outside air damper should the air temperature leaving the coil drop to a preset temperature (38 degrees F).
- e. The main air handler's discharge air shall be set on a reset schedule. The temperature shall be dictated by the room with the greatest demand.
- f. As space temperature rises above set point, the AHU shall utilize differential enthalpy to provide cooling to the space. If O/A is selected, then the O.A. damper shall modulate open and utilize the economizer. Mechanical cooling shall be utilized when the economizer is not appropriate. The internal EF shall modulate to accommodate.

2. Unoccupied cycle (only in applicable areas):

During the unoccupied cycle, the OA damper shall be closed; the space sensors shall cycle the supply fan and modulate the heating and cooling stages to maintain night setback temperature. It shall be possible to return the unit to the occupied mode by overriding the sensor program. The reset shall automatically return to its normal position at the beginning of the next automatic control cycle.

3.02 ENERGY RECOVERY VENTILATOR UNITS (ERV-1& 2) Reference schedules for applicable units for project scope.

A. Building ventilator Units – 50% or 100% outside air, as controlled by an occupancy sensor.

1. Occupied Cycle:

- a. The supply fan and exhaust fans shall run continuously. The fans shall run at full air flow according to a schedule.
- b. A photoelectric or ionization type duct smoke detector with manual reset shall be installed and located in the supply air of all units with an air flow of 2000 CFM or greater. The Mechanical Contractor shall wire the detector to stop the supply fan and stop the exhaust fan damper when smoke is detected.

2. Non Running cycle: (demand control)

Units to have integrated into there programming an unoccupied cycle, the exhaust and make up air fans shall not run, the space sensors shall cycle the supply fan and modulate the heating and cooling stages to maintain temp. It shall be possible to return the unit to the occupied mode by overriding the sensor program. The reset shall automatically return to its normal position at the beginning of the next automatic control cycle. Heating shall be by the in-floor.

3.03 MAKE-UP AIR UNIT (MAU-1)

A. MAU-1 (Kitchen Hoods Make-up Unit) - Pre-set outside air quantity, NG fired heat exchanger within unit module, controlled from discharge air temperature sensor.

1. Cooking Mode:

- a. The supply air fan shall run continuously. The staged burner shall stage to maintain a discharge temperature with a space sensor override.
- b. The outdoor air damper shall open to the 100% position.
- c. The kitchen exhaust hood fans shall run continuously during the cooking mode and be interlocked to MAU-1 for cooking mode.

2. Non-cooking Mode:

During the non-cooking mode, the MAU shall be off, the outside air damper shall be closed, and cooking hood exhaust fans shall be off. The unit shall return to cooking mode at any time that the kitchen hood is activated.

3.04 HEATING CIRCULATING PUMPS

- A. Heating/ Cooling pumps are to be activated automatically and to operate continuously based on the season. Season shall be determined by an outside air sensor.
- B. Pumps shall operate with a LEAD/LAG schedule on a run time totalization program. Switching at 100 Hr. intervals.
- C. Pumps shall modulate operation by use of VFD driven motors and be controlled by Delta P switch as located on plans. It is projected that the speed shall modulate from 50% to near 100% of designed capabilities.

3.05 CABINET UNIT HEATERS

- A. The room sensor will cycle the unit fan motor to maintain room temperature based on an established setpoint temperature.
- B. Below the setting of the aquastat, the unit fan will not run.

3.06 Base Board Radiation

- A. All BBR heat located in common areas shall be controlled by a wall mounted temperature sensor and/or a Danfoss control valve, as indicated on the plans.

3.07 VAV BOXES W/REHEAT

- A. All boxes shall modulate as required to maintain space set point. Occupied/Unoccupied shall be dictated by lighting controls.
- B. The coil associated with each box shall modulate it's 2-Way control valve to maintain space setpoint.

3.08 HEATING SYSTEM BOILERS- (B-1 & B-2)

- A. Boilers (B-1 & B-2) shall be enabled/disabled by the Building control system. The water temperature shall be controlled by the boiler on board controls and set up on a reset based on OA temp. Reference boiler spec. 235216 for boiler functions.
- B. Boilers shall comply with CSD-1 requirements.

3.09 HUMIDIFIERS

- A. Humidifiers shall be enabled/disabled by the DDC controls. Humidifiers shall maintain proper set points as per the wall mounted controls. The DDC system shall provide the space signal for proper control.
- B. The set point shall be set to 35% for winter operation.

3.10 EXHAUST FANS

- A. Specific Fans shall run continuously and be enabled/disabled by the DDC controls. Approximately 9 fans are to be operated by light switch in bathroom. Consult with Design Engineer for specific unit control.

END OF SECTION

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PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Labor, materials, equipment, tools supervision & start-up services.
- B. Electrical building system closeout.

1.02 SECTION INCLUDES

ELECTRICAL:	
SECTION 260000	ELECTRICAL GENERAL PROVISIONS
SECTION 260126	TESTING
SECTION 260500	BASIC ELECTRICAL MATERIALS AND METHODS
SECTION 260526	GROUNDING
SECTION 260620	PANEL BOARDS
SECTION 261000	SERVICE AND DISTRIBUTION
LIFE SAFETY SYSTEM:	
SECTION 283100	FIRE ALARM AND SMOKE DETECTION SYSTEM
CONTROLS:	
SECTION 250000	BUILDING CONTROL SYSTEM
SECTION 255100	SEQUENCE OF OPERATION

1.02 COORDINATION OF ELECTRICAL WORK

- A. Responsibility:
 - 1. The Electrical Contractor shall be responsible for his Sub-Contractors and Suppliers, and include in his bid materials, labor, and equipment involved, and install in accordance with local customs, codes, rules, regulations, jurisdictional awards, and decisions; and secure compliance of parts of the Specifications and Drawings regardless of Sectional inclusion in these Specifications.
 - 2. The Electrical Contractor and Sub-Contractor(s) shall be responsible for tasks applicable to his trade, as directed by the General Contractor, in accordance with the Specifications, Drawings, code requirements and shall be responsible for coordinating locations and arrangements of his work with all other relevant Mechanical, Architectural, Structural and Electrical Contractor's Specifications, Drawings and shop drawings. Coordinate work so that sprinkler heads, lights, diffusers, etc. are coordinated into Project and are installed per the architectural reflected ceiling plan.
- B. Site and Project Document Examination:
 - 1. Submission of a proposal is considered evidence that the Contractor has visited site and acquainted themselves with all existing conditions, made all necessary measurements, examined the Drawings and Specifications of all trades, including Mechanical, Architectural, Structural, and Electrical, and has fully informed himself with all Project and site conditions, and is proficient, experienced and knowledgeable of all standards, codes, ordinances, permits and regulations which affect the installation of his respective trade, and that all costs are included in his proposal.
 - 2. The Electrical Contractor and/or Sub-Contractor(s) shall obtain all required permits and assessments prior to starting work. Contractor shall verify requirement to include permits as part of his formal bid, as described in the General and Supplementary Requirements.
 - 3. No allowance shall subsequently be made in the Contractor's behalf for extra expense incurred due to failure or neglect on his part to make this site visit and examination.
 - 4. It is the responsibility of the Contractor to notify the Engineer, prior to submitting his bid, of any potential problems that he has identified during his site visit or from examination of the Contract documents.
- C. General Supports:
 - 1. Provide all necessary angle, channel, brackets or supplementary steel as required for adequate support for all conduit, specialties and equipment which is hung or mounted above floor. Secure approval from Architect, in writing, before welding or bolting to steel framing or anchoring to concrete structure.

2. Where conduit or equipment is suspended from concrete construction, set approved concrete inserts in formwork to receive hanger rods, such as structural steel channel, and where installed in metal deck use Ramset or welds as required.

D. Equipment Clearance:

1. Electrical Contractor to coordinate with the Architectural and Mechanical trades for equipment locations and to ensure adequate clearance is maintained, as required by the National Electrical Code and applicable state and local codes, as well as accessibility for future maintenance and operation.
2. Electrical work shall be arranged with building construction to provide minimum 6'-8" overhead clearance where possible.

E. Wall, Floor and Ceiling Openings:

1. Locate openings and advise the General Contractor/Construction Manager of details and templates of all openings necessary for inspection of electrical work.
2. In general, openings and required lintels shall be provided through the General Contractor/Construction Manager. Size and location is the responsibility of this Contractor. Cracks and rough edges left following installation of equipment shall be caulked or covered by Electrical Contractor.
3. Openings through drywall or concrete surfaces for supporting electrical equipment, including conduit penetrations, shall be drilled in a neat and work-like manner.
4. Electrical penetration holes through fire rated materials and systems shall be sealed in a manner to maintain the fire rating of that material and system.
5. Foam type sealer shall be used in accordance with the manufacturer's instructions for storage, hole preparation, mixing, and application. Two part foam type fire sealer shall be Dow Corning Silicone RTV, or approved equal.
6. Mechanical type fire stops shall be fitted to the opening and cable sizes, assembled, and installed per the manufacturer's instructions. Stops shall be Crouse-Hinds "TW Series, Thru-Wall-Barrier", Nelson Electric "Multi-Cable Transits", or approved equal.

F. Access Panels:

1. Items of equipment which require accessibility, adjustment, maintenance or observation such as junction boxes, controls, etc., shall be located and arranged for ready access either directly or through the use of access doors.
2. Notify the Engineer and all affected trades where and of what size and/or configuration access doors will be installed. Secure the approval of the Architect/Engineer for these locations and configurations.
3. Such access doors/panels shall meet or exceed the fire barrier rating of the floor, wall or partition into which they are inserted.
4. Access doors or panels, where required, shall be provided by the Contractor or Subcontractor whose equipment requires the access unless otherwise noted. This trade is to coordinate the access panel manufacturers with the architectural access panels.

G. Excavating and Backfilling:

1. Excavation and backfilling shall be performed in accordance with Division 2, Earthwork, and this Section.
2. Respective trades shall provide all trenching, excavating and backfilling as required for the installation of their work, including bracing, shoring and dumping as may be required. Provisions shall be made to ensure the safety of persons and property while work is proceeding as well as when the area is unattended.
3. Excavations shall conform to the required burial depth of equipment designated on the drawings, as required by field conditions, code requirements and as directed by the Engineer.
4. Enclose, support, barricade and mark all excavations as required and as directed by the

Architect/Engineer, or Owner's representative.

5. Exercise caution in excavation and personally check with all utilities (Call "Miss Dig") and the Owner for all required information on existing underground work in the area of the excavation. Repair all damage to existing underground work if damage is inflicted in the course of the excavation.
6. Obtain Architect/Engineer's permission, in writing, before any tunneling.
7. Provide separate trenches for each utility unless otherwise noted or directed.
8. Where electrical work is to be installed in filled or disturbed earth, raceways shall be supported by brick piers or other approved supports placed under the raceways and carried down to a firm bearing. All lines shall be laid straight and true alignment with the grade in the location established on the drawings or as directed by the Engineer.
9. Backfill under buildings, sidewalks, drives or parking lots shall be with 100 percent clean, non-cohesive sand. Compaction shall be in accordance with Division 2, Earthwork.

H. General Cleaning:

1. It shall be the responsibility of this Contractor to keep the premises free of accumulations of surplus material or rubbish caused by his operations and/or the operations of his Subcontractors. Combustible rubbish and debris shall be removed immediately. The trades shall remove their rubbish and debris from the project site promptly upon its accumulation.
2. Upon completion of the installation, the Contractor shall thoroughly clean all fixtures, equipment, boxes, raceways, controls, enclosures and other applicable equipment and accessories free of all foreign material.
3. All patching, repairing and painting required of surfaces damaged or allowed to deteriorate in the performance of this work made by this Contractor, where directed by the Architect/Engineer, shall be at this Contractor's expense.
4. If a Contractor does not remove rubbish or clean the systems as specified above, the Owner's representative reserves the right to have the work performed by others, with the cost back-charged to the Contractor who made the removal or cleaning necessary.

I. Field Changes:

1. The Contractor shall not make any field changes that affect timing, costs or performance without written approval from the Architect/Engineer in the form of a Change Order, Field Change Order or a Supplemental Instruction. The Contractor assumes liability for any additional costs for changes made without such instruction or approval. Should any unauthorized change be determined by the Architect/Engineer as lessening the value of the project, a credit will be determined and issued as a change to the contract.

1.03 STANDARDS, CODES AND PERMITS

- A. Refer to Division 1, General Requirements and Supplementary Conditions.
- B. All work installed under Electrical Sections shall comply with latest edition of applicable standards and codes of the following, including local codes and variances:
 - ADAG Americans with Disabilities Act Guidelines
 - AEIC Association of Edison Illuminating Companies
 - ANSI C2, American National Standards Institute
 - ANSI C73, Dimensions of Attachment Plugs and Receptacles
 - ASA American Standards Association
 - ASTM American Society of Testing Materials
 - ICEA Insulated Power Cable Engineers Association
 - IEEE Institute of Electrical and Electronics Engineers
 - OSHA Occupational Safety and Health Act
 - NEC Latest edition of (NFPA 70) as approved by the local authority having jurisdiction
 - NECA Standards for Installation
 - NEMA National Electric Manufacturers Association
 - NESC National Electric Safety Code (H13)
 - NETA National Electrical Testing Association, Inc.
 - NFPA National Fire Protection Association

UL Underwriter's Laboratories
Regulations of the local power utility company.

- C. Work shall be provided and tested in accordance with all applicable local, county, state laws, governmental ordinances, codes, rules and regulations.
- D. Contractor shall give all notices, file all drawings, obtain necessary approvals, obtain all permits, pay all fees, deposit and expenses required for installation of all work under this Contract.
- E. No work shall be covered or enclosed until work is tested in accordance with applicable codes and regulations, and successful tests witnessed and approved by authorized inspection authority.
- F. In general, material where applicable shall be labeled or listed by Underwriters' Laboratories, Inc. Assembled electrical equipment supplied to the job site shall be listed or labeled and/or approved by the authority having jurisdiction.
- G. In the event plans and specifications conflict with any rules, regulations or codes applying, said rules, regulations and codes shall govern the Contractor.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. After a schedule of Sub-Contractors is approved by the Engineer, submit eight (8) neatly bound copies of shop drawings (or number as directed by General Requirements) with one device or fixture of each type clearly identified (high-lighted, bolded, underlined, etc.) in each set on equipment and materials indicated on drawings or in the specifications.
 - 2. Submit complete manufacturer's shop drawings of equipment, accessories and controls, including dimensions, weights, capacities, construction details, installation, control methods, wiring diagrams, and motor data, etc.
 - 3. Engineer's approval of shop drawings is for general application only and is a service only and not considered as a guarantee of total compliance with or as relieving Contractor of basic responsibilities under Contract Documents, and does not approve changes in time or cost.
 - 4. After approval, each Contractor is responsible to provide information to other trades involved in, or affected by, installation of his equipment and work.
- B. Operating and Maintenance Instructions and Manuals:
 - 1. Electrical Contractor shall provide for all major items of equipment two (2) bound and indexed sets of operating/installation and maintenance instructions to Engineer for approval. After approval, manuals will be given to Owner by Engineer.
 - 2. Manuals shall include a complete set of shop drawings submitted, indexed with tabs for each section.

1.05 ELECTRICAL SERVICE REQUIREMENTS

- A. Electrical Contractor shall verify with the Utility Company the electrical system amperage, voltage and phase and report any variation from what is indicated on the drawings to the Engineer. Electrical Contractor shall obtain written verification of the available symmetrical and asymmetrical RMS fault current from the Utility Company and submit to the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Standards:
 - 1. Products shall be of established manufacturers regularly engaged in making type of materials to be provided and complete with all parts, accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- B. Substitution and Changes:
 - 1. Contractor and/or Equipment Supplier may propose alternate equipment or materials of equal quality,

function, durability and appearance as described and permitted in Specification Section 16000, 1.01.B. The substitution will take the form of an "Add-Deduct" to the bid proposal. It is the submitter's responsibility to provide sufficient material for review as required by Engineer's office. Acceptance and approval is the responsibility of the Engineer.

2. No substitutions will be accepted, except as authorized in a Project Addendum.
3. Contractor and/or Equipment Supplier is liable for any added costs to himself or others and is responsible for verifying dimensions, clearance and roughing-in requirements, when product not named as the basis of design is used and the Contractor is responsible for advising other Contractors of variations and, if requested, submit revised drawing layout for approval by the Engineer.

C. Explanation of Scheduled Manufacturers:

1. "Base Bid". This term designates that this equipment will be the product which the contractor generates his bid from. It is usually a component that is critical to maintaining the design intent. No other equipment suppliers will be allowed to bid as an "equal".
2. "Based On". This term designates that the equipment is designed around a certain product. Products of equal status are listed and may be bid as if they were the basis of design. The "based on" equipment shall serve as the standard to which equals will be judged.

2.02 EQUIPMENT REQUIREMENTS AND CONNECTIONS

A. Motor Starters and Controls:

1. Electrical Contractor shall provide manual or magnetic motor starters as required for motors not provided by Mechanical Trades and as indicated on Electrical Drawings and as specified within this Specification.
2. Mechanical Contractor shall provide factory installed motor starters integral with packaged equipment containing thermal overcurrent protection in ungrounded conductors with heater coils selected for specific motor usage for motors, unless otherwise shown on electrical drawings.

B. Electrical Wiring and Controls:

1. Mechanical Contractor shall provide motors, drives, controllers and safety switches integral to packaged equipment and factory mounted controls for mechanical equipment as indicated. When pre-wired equipment is used, control circuit shall be separately fused at control transformer and shall always revert to a fail-safe condition.
2. Mechanical Contractor or Temperature Control Contractor shall provide electrical devices requiring mechanical connections, and/or electrical connections, such as pressure switches, limit switches, float switches, solenoid valves, motor operated valves, motor operated dampers, fire stats, freeze stats, thermostats, override timers, E.P.'s, P.E.'s, temperature control cabinet, etc.
3. Mechanical Contractor or Temperature Control Contractor shall provide Class 2 and 3 wiring, conduit, boxes for their associated equipment unless otherwise noted.

Electrical subcontractor shall furnish and wire duct type smoke detectors. Duct type smoke detectors shall be installed by Mechanical Trades.

4. Electrical Contractor shall install power wiring and conduit to motors and/or factory mounted control panels as indicated on Drawings or as indicated in other sections of the Specifications.
5. Electrical wiring work by Mechanical Contractor and Temperature Control Contractor shall be in accordance with Division 16 requirements.

C. Owner Supplied Equipment:

1. Electrical Contractor is to provide power wiring, conduit, starters and safety switches on equipment as indicated on the drawings. Make final power connections to equipment. Any control wiring or remote power supplied by the equipment to remote units shall be provided by the Owner.

PART 3 - EXECUTION

3.01 CLOSEOUT

A. Final Acceptance:

Final acceptance and payment will only be made after final punch list completion and receipt at Engineer's office of:

- Certificates of Inspection
- Test Reports
- Guarantees/Warranties
- Record Drawings (As-Builts)
- Operating and Maintenance Instruction Manuals (2)

B. Certificates of Inspection and Test Reports:

The Contractor shall submit to the Engineer's Office evidence that installation has been inspected and approved by municipal or state electrical inspector and/or the authority having jurisdiction.

C. Guarantees and Warranties:

1. During the one year period of continuous operation (except if General Requirements specify a longer warranty period), make two complete inspections (one at 3 months and one at 6 months) of all systems, fixtures, equipment, safety devices and controls to ensure equipment operating properly, and report to Engineer in writing. Contact the Owner's Operation/Maintenance Supervisor to schedule site inspection.

D. Record Drawings:

1. Maintain a white-print set of Electrical Contract Drawings in clean, undamaged condition for mark-up of actual installation on Electrical Contract Drawings which vary substantially from the work as shown. These drawings are to be available for inspection by the Engineer on a weekly basis.
2. Submit as-built record drawings consisting of separate plans and riser diagrams for following systems:

- Power
- Lighting and Controls
- Fire Alarm/Life Safety System

Each system drawing shall show location, size and conductor fill for conduits, junction boxes and outlets. Specification changes shall also be submitted.

E. Operating and Maintenance Instructions:

1. Provide instruction of Owner's personnel in operation and maintenance procedures for all systems equipment.

F. Placing Systems into Operation:

1. Electrical Contractor shall be responsible for all start-up procedures, system checks and balancing associated with his equipment.
2. Equipment shall be installed, tested and operated in accordance with manufacturer's recommendations at normal operating conditions.
3. Permanent electrical equipment operated during construction periods shall be cleaned, and damaged equipment replaced.

G. Adjustments and Balancing:

1. Subsequent to beginning operation of the electrical power and distribution systems, the Contractor shall make all necessary adjustments to equipment installed or connected by him under this contract so as to ensure proper operation of the same. The Contractor shall measure, phase balance and make necessary adjustments to any portion of the electrical system that is substantially out of balance.

3.02 GUARANTEES AND WARRANTIES

- A. Labor, materials and equipment shall be guaranteed by Contractor and/or warranted by manufacturer for one year after acceptance date and/or one normal continuous complete season's operation applicable to equipment or system except where specified longer for special equipment. Contractor shall secure such warranty from Suppliers (not one year from shipment date), or Contractor to assume warranty.
- B. Acceptance date of substantial completion shall be Owner occupancy as determined by Architect/Engineer.
- C. Contractor shall make necessary alterations, repairs, adjustments, replacements during guarantee periods as directed by Architect/Engineer to comply with Drawings and Specifications at no cost to Owner.
- D. Repair or replacements made under guarantee bear further one year guarantee from date of acceptance of repair or replacement.

END OF SECTION

NOTE: THESE SPECIFICATIONS ARE THE PROPERTY OF THE ENGINEER AND ARE NOT TO BE REUSED OR REPRODUCED WITHOUT WRITTEN PERMISSION. THIS SPECIFICATION IS COPYWRITTEN.

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Test all circuits as soon as conductors are installed and make final tests when all work is complete. If circuits are not properly controlled and insulated at time of such final tests, the necessary extra repairs and tests shall be made at the Contractor's expense.
- B. All 240 and 208 volt wiring systems, sizes No. 4 AWG and larger, shall be given an insulation resistance test between conductors and between a single conductor and ground. Resistance shall not be less than 40 megohms. Measurements shall be made with all panelboards, overcurrent devices, etc., in place, and with circuit breakers or disconnect switches in the open position.
- C. Lighting and control wiring shall be tested for shorts or opens and shall be given a complete operational test.
- D. After installation is complete and properly adjusted, the various equipments and systems shall be demonstrated to operate in accordance with the requirements of the drawings and specifications.
- E. Tests, inspections and work shall be performed in the presence of and approved by the Owner's Representative before energizing the system.
- F. Power circuit breaker shall be tested and calibrated with results entered in the forms specified.
- G. Circuit breakers, including those equipped with static trip units, shall be tested by the use of a "Multi-Amp" or similar piece of equipment. Long-time delays shall be tested by placing three times the rated current of the trip unit through the breaker. Instantaneous tripping shall be tested by placing the full value of current through the breaker. Lesser amounts of current with "artificial" tripping will not be permitted.

3.02 FIRE ALARM AND SMOKE DETECTION SYSTEM (For Smoke System as required for Sprinkler sys)

- A. Include services of a manufacturer's certified representative to provide final testing, adjusting, and commissioning and instructing the Owner's Representative in the operation and maintenance of the system as listed herein.
- B. Test heads by using manufacturer's recommended detector tester with halogenated type gas and sensitivity tester when adjustable detectors are used. The manufacturer's certified technician shall evaluate the installation and operation of the system.
- C. Submit eight copies of test and evaluation reports to the Architect/Engineer.
- D. Control wiring shall be tested for shorts or opens and system shall be given a complete operational test.
- E. After installation and adjusting the Smoke Detection System, the various equipment and systems shall be demonstrated to operate in accordance with the requirements of the drawings and specifications.
- F. The whole system shall be tested and left in operating conditions. Testing shall be performed as directed by the Owner or Owner's Representative. Final test and inspection shall be performed with the Fire Marshall's Representative and Electrical Inspection Bureau Representative and done during Owner's normal working hours.
- G. The Contractor or its representative and the equipment manufacturer's representative shall be present at all inspections and be prepared to perform certain test functions and answer questions related to the equipment.
- H. Noise test shall be performed by the Contractor to ensure that the audible sound is heard everywhere and of a level acceptable to the Fire Marshall's Office. If the Fire Marshall's Office indicates that the sound level is too low from a device, the contractor shall replace the device at no cost to the owner.

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END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Shop drawing submittals
- B. Raceways, wire & cables, outlet boxes, wiring devices, motor starters & panels.
- C. Installation methods

1.02 IDENTIFICATION

- A. Service switches, motor disconnects, controllers, etc., whether or not furnished under this Division shall be marked to identify the equipment served and the origin of the power source. Branch panelboards, distribution panels, transformers, and switchboards shall be identified as to designation and voltage characteristics. **All identification shall be done with engraved plastic plates, black with white letters.**

1.03 DIRECTORIES

- A. **Provide each panel with a typewritten index.** Insert index into a transparent plastic holder secured to the inside of the panel door.

1.04 SUBMITTALS

- A. Shop Drawings
 - 1. Submit shop drawings for the following:
 - a. Wiring Devices and Switches.
 - b. Specialty Wiring Devices.
 - c. Starters.
 - d. Panel boards.
 - e. Safety Switches.
 - f. Transient Voltage Surge Suppression.
 - g. Lighting fixtures and controls.

PART 2 - PRODUCTS

2.01 RACEWAYS

- A. Wiring shall be installed in approved raceways where required by code and be a minimum size of 3/4" for homeruns unless otherwise noted. 1/2" conduit will be permitted for switch and receptacle runs in walls. Conduit or tubing shall be installed in a manner which complies with all applicable provisions of the National Electrical Code.
- B. Ends of conduit or tubing shall terminate in a bushing or fitting having factory installed insulating liners. Provide plastic bushings on conduit or tubing with wire larger than #4 AWG. Exposed runs shall be supported by hangers, clamps, or straps secured by toggle bolts in hollow construction or expansion bolts or inserts in poured or brick walls.
- C. Every precaution shall be taken to protect the conduit from damage and from water, dirt, concrete, etc., getting into the system during construction. Capped bushings shall be used on conduit terminations until wire is installed. If, in the opinion of the Engineer, conduit or tubing has become damaged or contains unremovable foreign matter, it shall be replaced at the Contractor's expense. Aluminum conduit is not acceptable in this contract.
- D. Intermediate metallic conduit (IMC) shall be hot dipped galvanized steel, and shall be used on all runs above 2-1/2" unless otherwise noted. Intermediate metallic conduit may be used in all poured construction, fill, outside masonry walls, areas exposed to weather, under drives and walks, and in areas where tubing may become damaged.
- E. Cast and threaded fittings for IMC shall be used on exposed conduit installed on walls below 8"-0" and on conduit exposed to weather.
- F. Plastic conduit shall be high strength smooth inner with polyvinyl chloride, heavy wall type equal to Carlon Schedule 40 for use as direct burial without concrete encasement, except as required by code. Couplings

shall be the solvent welded type. Circuits run in PVC conduit require a separate grounding conductor.

- G. Electric-metallic-tubing (thinwall conduit) shall be standard weight with manufacturer's name and Underwriters' Label on each length. Maximum permissible size tubing shall be 2-1/2".
- H. Tubing may be used for feeders and branch circuits above suspended accessible ceilings; for switch and receptacle legs which terminate above suspended accessible ceilings and for exposed feeders and branch circuits.
- I. Metal conduit and EMT fittings should be galvanized malleable iron, steel, aluminum, or zinc die-cast. Connectors and couplings shall be threaded, set-screw, or compression type, and concrete-tight and/or rain-tight where required. Conduit bodies shall be malleable iron or aluminum cover gaskets exposed to weather.
 - 1. Expansion Fittings: cast or malleable iron bodies, with threaded end caps for receiving fixed and moveable conduits, metallic pressure packing, and copper bonding jumper assembly. Fittings shall provide for minimum 2" of movement of conduit in either direction. Fittings shall be Appleton type "XJ" or similar fittings by another approved manufacturer.
 - 2. Expansion-Deflection Fittings: neoprene sleeve secured to silicon bronze threaded couplings by means of stainless steel bands. Fitting shall be designed to provide for movement of not less than 3/4" from normal in all directions and shall be complete with tinned flexible copper braid bonding jumper protected by neoprene sleeve and securely bolted to couplings for grounding continuity through joint. Fittings shall be O.Z./Gedney Electric Company, type "DX" or similar fittings by another approved manufacturer.
 - 3. Locknuts: malleable iron or steel. Bushings shall be malleable iron or steel, or plastic. Malleable iron or steel bushings shall be zinc or cadmium plated and shall have insulating insert of thermosetting plastic molded and locked into bushing ring. Plastic bushings shall be thermosetting phenolic insulating type conforming to Federal Specification W-F-406 and Amendment 6. Use of non-rigid plastic bushings is prohibited.
- J. Flexible metal conduit shall be used for connections to the following equipment: Motors and mechanical equipment. Maximum length of flexible metallic conduit shall be 6'-0". Minimum size shall be 1/2". Flexible metal conduit used for lighting fixture connections shall be "Greenfield" type. Fittings shall be insulated throat, flex-steel connectors. Flexible metal conduit used for equipment other than lighting fixtures shall be similar to "Greenfield" except jacketed with a plastic outer cover and terminated with appropriate factory-installed fittings, UL Labeled.
- K. Flexible metallic conduit shall have separate grounding conductor.
- L. Space around conduits at wall penetrations shall be filled with mortar, or other approved filler, maintaining the rating of wall/ceiling construction as required.

2.02 WIRES AND CABLES

- A. Wiring:
 - 1. Shall be THHN stranded copper, single conductor, and shall be installed in conduit or tubing unless specified otherwise (areas required: garage, mechanical & electrical rooms and exterior).
 - 2. May be aluminum SER cable, single conductor, and shall be installed in conduit or tubing unless specified otherwise (areas required: garage, mechanical & electrical rooms and exterior. Primary feeders and sub-panel feeders only.
- B. Romex shall be acceptable in wood frame construction as directed by NEC.
- C. M.C. Cable shall be acceptable in steel stud construction as directed by NEC.
- D. Conductors shall be continuous between outlets or junction boxes with splice made only within such boxes.
- E. No wire smaller than #12 may be used unless specified under descriptions of special systems. Control wiring may be #14 AWG or smaller as indicated, and shall be stranded.
- E. Cables for smoke detection systems or for use in plenums without conduit shall be UL listed, UL Style 1330, meeting ASTM D-2116 and ICEA color codes.
- F. Wire for general interior, exterior, and control use, sizes #14 AWG through 500 MCM, shall be single conductor, insulated for a minimum of 75 degrees C, THHN, THWN, or XHHW, elsewhere, and be rated 600 volts. Where required ampacities can only be satisfied by conductor sizes larger than 500 MCM, parallel conductors shall be used.

- G. Wire for final connection at HID and incandescent lighting fixture sockets shall be NEC type SF-2 fixture wire rated 200 degrees C, 600 volts.
- H. Wire for use in fluorescent fixture wiring channels shall conform to NEC Types THHN or XHHW, rated 90 degrees C, 600 volts.
- I. Ground wire for interior use shall be green insulated, stranded copper. and shall meet requirements of wire for general interior use.
- J. Branch circuit wiring shall be color coded, red, black, blue for phase wiring, and white neutral. Bonding conductors shall be green or bare. Phase color coding shall be consistent throughout the entire branch circuit system.
- K. All neutral runs including feeders shall be white full length of conductor.

2.03 WIRE CONNECTORS AND JOINTS

- A. Conductors #6 AWG and smaller shall be joined with electrical spring connectors with vinyl insulating cap. Conductors larger than #6 shall be joined by compression type connectors.

2.04 OUTLET BOXES

- A. A standard galvanized or plastic outlet box shall be installed for each and every outlet shown.
- B. Set boxes squarely with faces flush to finished surfaces. The exact location of all outlets shall be approved by the Architect/Engineer before same are placed and Contractor shall consult Architect/Engineer at all times relative to the location of outlets. No outlets shall be placed behind plumbing or heating pipes or where they will interfere with ducts, pipes, equipment, or other work. Outlets not located in accordance with these instructions shall be relocated when so directed by the Architect or General Contractor by this Contractor at his expense including cost of any cutting and patching the work of other trades as may be required by such relocation.
- C. Each outlet shall be rigidly supported from the building construction (independent of the raceway system).
- D. Ceiling outlet boxes shall be 4" octagon, minimum 1-1/2" deep, with fixture hickey, and supported to withstand 80 pounds.
- E. Convenience outlet and switch boxes shall be a minimum of 2-1/8" deep. When installed in poured walls, 2-1/2" minimum deep box shall be used; when installed in masonry, 3-1/2" minimum deep box shall be used.

2.05 JUNCTION BOXES AND PULL BOXES

- A. When used, pull boxes and junction boxes shall be galvanized and have flat steel covers fastened with screws and set flush with the finished surface and located in an accessible area. When installed in damp locations, gaskets and seals shall be provided. Junction boxes shall be sized to meet N.E.C. Standards based on conduit and conductors. Provide identifying labels on each box.

2.06 WIRING DEVICES

- A. Receptacles
 - 1. Receptacles shall be mounted approximately 1'-4" above floor to bottom or at other heights indicated on Drawings.
 - 2. Contractor shall be responsible for masking receptacles for protection from painting, plastering, etc.
 - 3. Receptacles shall be commercial specification grade as manufactured by Hubbell, Leviton, or General Electric.
 - a. 20 Amp, 125 Volt, duplex, ground fault, (NEMA 5-20R), Hubbell GF-5352-W series, with #CWP26H outdoor weatherproof cover for exterior use.
 - b. 20 Amp, 125 Volt, duplex (NEMA 5-20R), Hubbell CBR20W series.
 - c. 20 Amp, 125 Volt, duplex with isolated ground (NEMA 5-20R), Hubbell IG5362 series.

- d. 30 Amp, 125/250 Volt (NEMA 10-30R), Hubbell 9350 series.
- e. 50 Amp, 125/250 Volt (NEMA 10-50R), Hubbell 7962 series.

NOTE: GFCI receptacles must meet UL 2003 Standards.

B. Wall Switches

- 1. Wall switches shall be mounted approximately 4'-0" above floor to top unless they interfere with wainscoting or trim. Switches shall be commercial specification grade, totally enclosed molded composition, silent type, spring action silver contacts, and rated at 120/277 volts A.C. Switches shall be binding screw type, side and back wired type.
- 2. Contractor shall be responsible for masking switches for protection from painting, plastering, etc.
- 3. Contractor shall confirm door swings with Building Trades Contractor before installing switches.
- 4. Switches shall be rated at 20 Amp, white in color, Hubbell CSB120 series, Leviton, or General Electric, or P & S switches of equivalent grade or as noted on construction drawings. Switches shall be single pole, double pole, three-way, keyed (master), or other type as indicated.

C. Wall Plates

- 1. Wall plates shall be installed plumb and level with all edges in contact with attaching surface. **Plates shall be brushed smooth stainless steel.** Provide blank cover plates for all data and telephone outlet boxes shown on plans. Plates used on exposed surface mounted outlets shall be the raised pressed metal type, stainless steel finish, to accommodate the device and cover the outlet box, without fillers of any kind. Mounting screws shall be metal with same finish as plate and with countersunk head. Plates shall be single, ganged, or combination, to accommodate arrangement indicated on drawings. Arrow-Hart, Leviton, General Electric, Hubbell, or P & S plates of equivalent grade will be acceptable.

2.07 SPECIALTY WIRING DEVICES

A. Thermostat/Sensors:

For each of the thermostats/sensors shown, a single gang box with a 1/2" conduit in new areas, or a single gang box with wiremold (to match existing) in existing areas, stubbed to the unit being controlled. Up to accessible ceiling or from controller to unit in non-accessible ceilings. Box mounted at 44" A.F.F.

B. Smoke Sensors for HVAC units 2000 cfm or more (Reference Mech. Plans):

It shall be required that the E.C. provide and install the necessary code required alarming/signaling equipment as related to the smoke sensors for HVAC units 2000 Cfm or more.

2.08 MAGNETIC STARTERS - COMBINATION TYPE; THREE-PHASE MOTORS

- A. In general, the magnetic starters shall be of the minimum NEMA 0, combination type consisting of a circuit protective device, switch and fuse type, and a NEMA size starter as required. Circuit protective device shall be a fused type "A" safety switch. The motor starter shall comprise of NEMA size contactors, overload relays, heaters, interlocks, etc. The hinged cover shall be so interlocked that it may not be opened when the switch is in the "ON" position, except that the interlock shall be tool-releasable by a qualified person. Starters shall have provisions for padlock. The motor starter shall include phase loss and phase unbalance protection, or auxiliary devices shall be installed to accommodate these types of protection.
- B. Each combination starter unit shall be furnished with HAND-OFF-AUTO selector switch, green running light, and with individual control transformers, with fused secondary, rated 120 volts. Starters shall be supplied with two N.O. contact.
- C. Starters shall be by Square D. General Electric or Cutler Hammer maybe bid as alternates.

2.10 SINGLE PHASE MOTOR STARTERS

- A. Manual starters for fractional horsepower single phase motors shall be single or double pole with pilot lights and thermal overload relay elements. Enclosure shall be NEMA 1, surface or flush mounted as indicated with provision for padlocking unless described otherwise on drawings. Thermal overload elements shall be sized on basis of motor rating and starter manufacturer's instructions. Units shall be General Electric "Type CR-101," Square D "Class 2510," or Cutler Hammer.

2.11 FUSESTATS

- A. Fusestats shall provide overload protection and may be used for permanently wired motors rated up to 1/2

HP, 125 Volt A.C. only.

- B. Fusestat base shall be constructed of pre-galvanized steel plate with a hood of galvanized steel and fit on a standard double gang 4" square box.
- C. Fusestat shall consist of a fused outlet and switch and be by Steel City, Catalog No. F8-S, or equal by other approved manufacturer.

2.12 PANELBOARDS

- A. Panelboards shall be of the circuit breaker type with main lugs or main breaker as indicated on Drawings. Use full size plug-in/bolt-on type branch circuit breakers (tandem type are not permitted). Branch circuit breakers shall be rated a minimum 10,000 amperes interrupting capacity symmetrical. The capacity shall be determined by the job conditions. It is the installing contractor's responsibility to guaranty that the requirements are met.
- B. Branch circuit panelboards shall be Square "D" type QO 'Load Center', NQOD, NF, I-line. General Electric or Cutler Hammer, may submit voluntary alternates of equal quality. All panels shall meet Federal Specifications W-P-115A.

2.13 FUSES

- A. Fuses 600 Amperes and Less: Dual element, current limiting, time delay, one-time fuse, 250 or 600 volt as required, UL Class J.
- B. Interrupting Rating: 200,000 rms amperes.

2.14 SAFETY SWITCHES

- A. Furnish and install required safety switches.
- B. Safety switches shall be NEMA heavy duty type "HD", fusible or non-fusible as indicated, and Underwriter's Laboratory approved. Switches shall be furnished in NEMA-1 enclosures unless otherwise shown on drawings. Weatherproof switches shall be NEMA-3R (raintight).
- C. Switches shall be Square D, or equal by General Electric or Cutler Hammer.

2.15 SUPPORTS AND HANGERS

- A. Provide and install necessary steel brackets, rods, clamps, etc., for support of work under this contract. Supports shall be plated or painted and shall be secured to structural members after Architect's approval.

2.16 SLEEVES AND INSERTS

- A. This Contractor shall be responsible for the proper location on all sleeves, chases, openings and inserts for the installation of his equipment.
- B. Holes through walls, floors, or structural members for electrical conduit and equipment shall be drilled in a work-like manner and be located only where permitted by the Architect or Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Conduits shall be cut, bent, joined, and installed per manufacturer's instructions, U.L. General Information, and the N.E.C.
- B. Outdoor and underground encased coupling and conduit threads shall be treated with mastic or similar compound to prevent entry of water.

3.02 INSTALLATION METHODS

- A. Conduit runs shall be placed neatly and orderly at parallel or perpendicular lines to building walls.
- B. Conduit runs parallel to or crossing uninsulated hot water or steam pipes shall be separated from same by 12" if parallel, or 7" if crossing. Where hot water or steam pipe lines are insulated, conduit shall clear insulation surface by 2". Conduits shall not be installed directly under cold water pipes.
- C. No more than two concealed conduits shall cross over at same point in a poured slab.
- D. Conduit and pull boxes shall be installed mechanically secure to permit pulling in or pulling out of cable proposed for same. Double locknuts and bushing shall be used for termination of conduit at boxes and equipment.
- E. Joints of conduits shall be tight, low resistance connections.
- F. **A #6 pullcord shall be provided for new empty conduits.** Pullcord shall be wax impregnated, nylon, or other synthetic material resistant to moisture and mildew to prevent deterioration.
- G. ALL ELECTRICAL ITEMS AS SHOWN ON MASONRY WALLS SHALL HAVE CONDUIT INSTALLED ON THE INSIDE OF WALL WITH FLUSH MOUNTED ITEMS.

3.03 FAULT CURRENT REQUIREMENTS

- A. Every effort shall be made by the installing contractor to guaranty that all distribution panels, panelboards and safety switches will be able to safely clear (interrupt) the amount of short circuit amps that could flow on a bolted phase to phase fault.
- B. All stated fault currents within the bid documents shall be verified to be correct by the installing contractor.
- C. If an error is found in the fault current stated, the contractor shall install the proper devices to maintain required levels.

END OF SECTION

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PART 1 – GENERAL

1.01 RELATED SECTIONS

- A. Section 16000 – GENERAL ELECTRICAL PROVISIONS
- B. Section 16050 - BASIC ELECTRICAL MATERIAL METHODS

1.02 REFERENCES

- A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1 Verify exact locations of underground metal water service pipe entrances to building.
 - 2 Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3 For signal reference grids, coordinate the work with access flooring furnished in accordance with Section 09 6900.
 - 4 Notify Strategic Energy Solutions, Inc. of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms.
- B. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.
- C. NEMA - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. UL, cUL, and CSA Approved.
- E. IEEE Standard 444 (ANSI-C343).
- F. IEC: 146A.

1.06 SCOPE

- A. The grounding system shall be in accordance with the drawings, specifications and with the National Electrical Code, NEMA, USASI and IEEE Standards, latest editions, where these standards apply. The ground bar of the main service disconnect enclosure shall be bonded to water mains, structural steel, and driven ground rods, by grounding electrode conductor, and as indicated on the drawings. Methods in accordance with good accepted practice for this type of work which cover conditions not indicated on the drawings or described in these specifications and which meet with the approval of the Engineer shall be used in order to secure a good substantial and permanent grounding system. Maximum ground resistance to be per N.E.C.
- B. All interconnections, risers, cables, etc. shall be provided and installed for grounding transformers, main

switchboard, panelboards and other equipment. Bonding jumpers shall be copper, equal in cross section to the corresponding ground connectors and attached by solder less lugs, compression connections, or clamps. All ground connectors shall have brazed connections, unless otherwise indicated, such as Cadwell, Burndy, Thomas and Betts or equal as approved.

- C. Ground cables shall be protected by sleeves where the cable extends through a concrete surface. Ground inserts shall be used where ground cables extending through the surface would be exposed to mechanical damage during or after construction.
- D. Where ground cables are installed in rigid metal conduit, the cables shall be bonded to the conduit at both ends of the run.
- E. Welds on ground cables shall be cleaned and painted with an asphalt base paint where buried underground or imbedded in concrete.
- F. Miscellaneous and special systems shall be properly grounded in accordance with the requirements of each system.

1.07 BRANCH CIRCUIT GROUND WIRE

- A. Provide a #12AWG green grounding wire in each conduit in addition to the circuit wires (phase and neutral wires). The grounding wire shall be connected to grounding terminal bars (to be furnished with each distribution panel) in panelboards, and these bars shall be grounded to the system master ground at switchboard.
- B. All equipment, fixtures, receptacles, etc. shall be grounded by means of a separate green ground wire. These wires shall be connected to the respective distribution panel grounding bar, equipped with the required quantity of screw terminals.
- C. All isolated ground receptacles require a separate #12AWG ground wire from the receptacle to the isolated ground bus within the panel.
- D. Circuits run in PVC conduit will require a separate grounding conductor, provided and installed at no additional cost.
- E. All isolated ground circuits shall be connected to a separate ground bar. A separate ground conductor shall be installed for the additional ground bar and be grounded by a separate method from the panel grounding bar.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Strategic Energy Solutions, Inc.. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- E. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal Building or Structure Frame:

a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.

4. Concrete-Encased Electrode:

a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.

5. Ground Rod Electrode(s):

- a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
- b. Space electrodes not less than 10 feet from each other and any other ground electrode.
- c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
- d. Provide ground enhancement material around electrode where indicated.
- e. Provide ground access well for each electrode.

1 Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

2 Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

a. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.

b. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

c. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

F. Separately Derived System Grounding:

1. Separately derived systems include, but are not limited to:

- a. Transformers (except autotransformers such as buck-boost transformers).
- b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
- c. Generators, when neutral is switched in the transfer switch.

1 Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.

2 Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.

3 Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

4 Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

G. Bonding and Equipment Grounding:

1 Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

- 2 Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
- 3 Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
- 4 Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- 5 Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
- 6 Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
- 7 Provide bonding for metal building frame where not used as a grounding electrode.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

- 1 Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- 2 Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 0519:

1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions: 1) Use bare copper conductors where installed underground in direct contact with earth. 2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

- 1 Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
- 2 Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
- 3 Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:

- 1 Description: Copper rectangular ground bars with mounting brackets and insulators.
- 2 Size: As indicated.
- 3 Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:

- 1 Comply with NEMA GR 1.
- 2 Material: Copper-bonded (copper-clad) steel.
- 3 Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
- 4 Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Tighten accessible connections and mechanical fasteners after placing.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and testing to be performed under provisions of Section 16000.

END OF SECTION

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PART 1 - GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section.

1.02 QUALITY ASSURANCE

- A. Panelboards shall be UL label and nameplate, and shall conform to latest NEMA and NEC standards.

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. After a schedule of Sub-Contractors is approved by the Engineer, submit eight (8) neatly bound copies of shop drawings (or number as directed by General Requirements) with one device or fixture of each type clearly identified (high-lighted, bolded, underlined, etc.) in each set on equipment and materials indicated on drawings or in the specifications.
 - 2. Submit complete manufacturer's shop drawings of equipment, accessories and controls, including dimensions, weights, capacities, construction details, installation, control methods, wiring diagrams, and motor data, etc.
 - 3. Engineer's approval of shop drawings is for general application only and is a service only and not considered as a guarantee of total compliance with or as relieving Contractor of basic responsibilities under Contract Documents, and does not approve changes in time or cost.
 - 4. After approval, each Contractor is responsible to provide information to other trades involved in, or affected by, installation of his equipment and work.

PART 2 - PRODUCTS

2.01 PANELBOARDS

- A. Panelboards General Requirements: Shall be factory assembled and conform to following:
 - 1. Flush or surface mounted galvanized steel cabinet as indicated.
 - 2. Hinged and lockable door with trims on circuit breaker panelboards.
 - 3. Individual hinged and lockable doors on fusible type power distribution panelboards.
 - 4. Locks keyed alike.
 - 5. Manufacturer's standard prime paint and factory finish.
 - 6. Heavy plastic covered typewritten directories.
 - 7. Voltage, phase and capacity as indicated on schedules.
 - 8. Internal assembly of circuit breakers or switch and fuse units as indicated.
 - 9. Circuit breakers and switch and fuse characteristics as specified.
 - 10. Ground fault circuit interrupter type circuit breakers where indicated on the panelboard schedules.
 - 11. Approved terminal grounding bar for general branch circuit equipment grounding conductors.
 - 12. Approved isolated grounding bar for isolated ground receptacle grounding conductors.
 - 13. Interrupting capacity of a minimum 10,000 A.I.C. (amperes rms symmetrical) for branch circuit breakers and a minimum 22,000 A.I.C. for main breakers in distribution or branch panelboards as indicated.

14. Panelboards used for service entrance shall be so labeled and listed for such use and shall have separately barriered provisions for connection of emergency circuit loads. Non-linear load type panels shall be required for designated computer equipment panels.
 15. Panelboards shall be by Square D, type QO 'Load Center', NQO, I-Line.
- B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
- 1 Altitude: Less than 6,600 feet.
 - 2 Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:
1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
- 1 Provide fully rated neutral bus where neutral is indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2 Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
- 1 Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
 - 2 Main and Neutral Lug Type: Mechanical.
- C. Bussing:
- 1 Phase and Neutral Bus Material: Copper.

- 2 Ground Bus Material: Copper.

D. Circuit Breakers:

- 1 Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- 2 Provide thermal magnetic circuit breakers unless otherwise indicated.

E. Enclosures:

- 1 Provide surface-mounted enclosures unless otherwise indicated.
- 2 Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
- 3 Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

- 1 Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
- 2 Main and Neutral Lug Type: Mechanical.

C. Bussing:

- 1 Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
- 2 Phase and Neutral Bus Material: Copper.
- 3 Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

- 1 Provide surface-mounted or flush-mounted enclosures as indicated.
- 2 Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
- 3 Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1 Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2 Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:

- 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
- 2) 14,000 rms symmetrical amperes at 480 VAC.

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

Do not use handle ties in lieu of multi-pole circuit breakers.

Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

2.06 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Practice of drilling and tapping or drilling and using self-tapping fasteners in aluminum conductor bars for making electrical or mechanical support connections is prohibited in panelboard construction. Connections may be made by use of through-bolts with lock washers, Belleville washers, steel nuts or steel inserts. Steel helical inserts are not acceptable.
- B. Manufacturers who cannot or prefer not to use such methods, shall provide copper bus bars. Copper shall also be provided where required by local or state ordinances.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Bidding Requirements, Project Guidelines and General Requirements (Division 1) apply to the work specified in this Section.

1.02 DESCRIPTION

- A. Work Included:
 - 1. This Section includes all labor, materials, equipment, tools, supervision, start-up services and Owner's instructions, including all incidental and related items necessary to complete installation and successfully test, start-up and operate in a practical and efficient manner all services and distribution work indicated on the drawings.
 - 2. In general, this shall include, but not be limited to:
 - a. Temporary Power
 - b. Service
 - c. Distribution
- B. Related Work:
 - 1. The applicable requirements from other Sections for related work shall form a part of the service and distribution work and this Contractor shall consult them in detail for general and specific requirements.
- C. Quality Assurance:
 - 1. Qualifications:
 - a. All service and distribution work shall be performed by licensed electricians.
 - 2. Installation:
 - a. Installation methods shall conform to manufacturer's standards for each piece or item of equipment.

1.03 TEMPORARY POWER

- A. General:
 - 1. The Electrical Contractor is to provide temporary construction power facilities throughout the building(s) for his own use and for other use by the various trades. All enclosed rooms shall be equipped with temporary lighting so that work may proceed. Provide power outlets where requested by the various trades. (Note: This shall not be construed as indicating that the Electrical Contractor is to provide any and all voltages at any and all capacities to run heavy power tools, mixers, electric dryers, etc. Normal, 120/208 volt, single-phase power will be provided.) Comply with OSHA Lighting Standard Subpart D, Rule 1926.56(a) and (b). Provide maintenance service for power and lighting facilities, including lamp replacement, during normal working hours.
- B. Extensions and/or Extension Cords:
 - 1. If any Contractor requires an extension cord, it shall be provided by that Contractor. Should he require lighting or power in addition to that described in A above, he shall provide it in order to complete his own work. Such additional loads must be coordinated with the Electrical Contractor so that cables and/or circuits are not overloaded.
- C. Temporary Connections:
 - 1. The Electrical Contractor shall provide temporary connections for the testing or operation of permanent or temporary motors, pumps, burners, unit heaters or similar units when temporary heat or ventilation is required during construction.
- D. Use of Permanent Lighting System:
 - 1. After the installation of the permanent lighting system, it may be used for construction lighting as required. Refer to Section 260500.

E. Codes:

1. Complete temporary power and lighting distribution system shall be in complete accordance with all applicable codes.

1.04 SERVICE

A. New Electrical Service (See Plans):

1. The building shall be fed by a completely new electrical service as herein described and as shown on the drawings.
2. The Electrical Contractor shall furnish and install a new underground secondary service from the transformer to the new main service distribution panel located the Storage Room #105. Refer to drawings for location and One Line Diagram for size and type.
3. The Electrical Contractor shall furnish and install a new 120/208 volt, three-phase, four-wire service entrance main switchboard. This switchboard shall be located in Storage Room #105. Refer to the One Line Diagram for type and size.

1.05 DISTRIBUTION

A. Distribution System:

1. This Contractor shall furnish and install a new distribution system for the building as shown on the drawings and the One Line Diagram.
2. All feeders shall be run continuously without splices, and be type THHN or THWN, unless otherwise noted.

END OF SECTION

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Part 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Section 260000 – GENERAL ELECTRICAL PROVISIONS.
- B. Section 230000- GENERAL MECHANICAL PROVISIONS

1.2. SUMMARY

1.2.1. FIRE

Provide all permits, labor, equipment, materials and services to furnish and install a fully tested functional, UL Listed, code compliant, intelligent addressable fire alarm, emergency communications and active smoke control system including but not limited to all initiation and notification appliances, all raceways and wiring, connection to a central monitoring station.

The system supplied under this specification shall utilize modular low voltage design with direct wired, node to node, peer-to-peer network communications. The system shall utilize independently addressed, fire detection devices, input/output control modules, audio amplifiers, telephone communications and notification appliances as described in this specification. Network panels shall contain the required user interfaces for all functions. All equipment shall be new and the current products of a single manufacturer, actively engaged in the manufacturing and sale of digital fire detection devices for over ten years.

Also included are system wiring, raceways, pull boxes, terminal cabinets, mounting boxes, and any accessories and miscellaneous items required for a code compliant system.

The system drawings show the intended of coverage and suggested device locations. Final device quantity, location, and AHJ approval are the responsibility of the contractor.

The final system shall be complete, tested, and ready for operation as described elsewhere in this specification, before owner acceptance.

Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, is compatible with existing systems, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.

1.2.2. RELATED WORK - FIRE

- A. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:
 - 1. Sprinkler water flow and supervisory switches shall be furnished and installed by the fire protection contractor, but wired and connected by the electrical contractor. Modification of existing sprinkler devices to accommodate monitoring by the new fire alarm system shall be the responsibility of the fire alarm system installing contractor.
 - 2. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.
 - 3. New air handling and smoke exhaust system fan control circuits and status contacts to be furnished by the HVAC control equipment.
 - 4. Elevator recall control circuits to be provided by the elevator control equipment.
 - 5. Dry pipe/deluge sprinkler system release valve control circuits and supervision contacts shall be provided by the dry pipe/deluge sprinkler system control equipment.
 - 5. Kitchen hood extinguishing systems status monitoring.
 - 6. Fire pumps (manual, automatic and special service) status monitoring.
 - a. Pump failure (fail to start) indication
 - b. Pump running indication
 - c. Phase reversal indication

1.3. CODES-GENERAL

All work and materials shall conform to all applicable federal, state and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the engineer for resolution. National standards shall prevail unless local codes are more stringent.

The bidder shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the engineer.

1.3.1. FIRE CODE

The equipment and installation shall comply with the provisions of the following codes and standards unless the authority having jurisdiction has adopted an earlier version:

National Fire Protection Association (NFPA)

NFPA 70 - 2011 *National Electric Code*®

NFPA 72 - 2010 *National Fire Alarm Code*®

NFPA 90A - 2012 *Installation of Air-Conditioning and Ventilating Systems*

NFPA 92A - 2009 *Smoke-Control Systems Utilizing Barriers and Pressure Differences*

NFPA 92B - 2009 *Smoke Management Systems in Malls, Atria, and Large Areas*

NFPA 101- 2012 *Life Safety Code*®

Underwriter's Laboratories, Inc

UL 864 - Control Units for Fire Protective Signaling Systems.

UL 268 - Smoke Detectors for Fire Protective Signaling Systems.

UL 268A - Smoke Detectors for Duct Applications.

UL 217 - Single and Multiple Station Smoke Alarms

UL 521 - Heat Detectors for Fire Protective Signaling Systems.

UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

UL 464 - Audible Signaling Appliances.

UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

UL 346 - Water flow Indicators for Fire Protective Signaling Systems.

UL 1971 - Signaling Devices for the Hearing-Impaired.

UL-1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

UL 1481 - Power Supplies for Fire Protective Signaling Systems.

UL 1711 - Amplifiers for Fire Protective Signaling Systems.

UL 1635 - Digital Alarm Communicator System Units

UL-1638 - Signaling Appliances - Private Mode Emergency and General Utility Signaling

Factory Mutual (FM) approval

Local codes and standards:

Michigan Electrical Code

Michigan Building Code

Michigan Fire Code

Michigan Mechanical Code

Federal Codes and Regulations

Americans with Disabilities Act (ADA)

Electrical Industries Association

EIA-232-D: Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment

Employing Serial Binary Data Interchange

EIA-485: Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems

1.3.2. DEFINITIONS AND ABBREVIATIONS

ACU: Autonomous Control Unit.

ADA: Americans with Disabilities Act.

AFF: Above Finished Floor.

AHJ: Authority Having Jurisdiction.

Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.

Circuit: Wire path from a group of devices or appliances to a control panel or transponder.

CCS: Central Control Station.

CPU: The central computer of a multiplex fire alarm or voice command control system.

SECTION 283100

INTEGRATED LIFE SAFETY SYSTEM

Page 2 of 40

ECS: Emergency Communication System.
FACP: Fire Alarm Control Panel.
FCC: Fire Command Center.
FM: FM Global (Factory Mutual)
FSCP: Firefighter's Smoke Control Panel.
HPSA: High Power Speaker Array.
HVAC: Heating Ventilating and Air Conditioning.
IDC: Initiating Device Circuit.
LCD: Liquid Crystal Display.
LED: Light Emitting Diode.
LOC: Local Operating Console.
MN: Mass Notification.
MNEC: Mass Notification Emergency Communications.
NAC: Notification Appliance Circuit.
NFPA: National Fire Protection Association.
NICET: National Institute for Certification in Engineering Technologies
NRTL: Nationally Recognized Testing Laboratory
PTR: Printer.
RCP: Remote Control Panel
SLC: Signaling Line Circuit.
Style 1: As defined by NFPA 72, Class B.
Style 4: As defined by NFPA 72, Class B.
Style 6: As defined by NFPA 72, Class A.
Style 7: As defined by NFPA 72, Class A.
Style B: As defined in NFPA 72, Class B.
Style D: As defined in NFPA 72, Class A.
Style Y: As defined in NFPA 72, Class B.
UL or ULI: Underwriters Laboratories, Inc.
UL Listed: Materials or equipment listed and included in the most recent edition of the UL Fire Protection Equipment Directory.
Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

1.4. SYSTEM DESCRIPTION GENERAL

Related documents

Summary

Fire

Related Work - Fire

Codes-General

Fire Code

Definitions and Abbreviations

System Description - Fire

General Fire and ECS

The system supplied under this
- Fire

1.4.1. GENERAL FIRE AND ECS

The system supplied under this specification shall be a new UL Listed modular fire alarm network that uses independently addressed fire detection devices, input/output control modules, amplifiers and speakers.

The network shall utilize token ring, peer-to-peer communications. The network shall consist of a main panel and remote control panels. To enhance survivability, each panel shall be an equal, active functional member of the network, capable of making all local decisions and initiating network tasks for other panels. In the event of a panel failure or communications failure between panels, panels shall be capable of forming sub-networks and remain operational between communicating panels. Master/slave system configurations shall not be considered as equal.

The system shall be fully field programmable such that virtually any combination of system output functions may be correlated to any type of input event(s). Inputs may be combined using Boolean logic, be time dependent or under manual control, as defined by required system operation. All software operations are to be stored in a non-volatile programmable memory within the fire alarm control panels. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.

Addressable smoke detector sensitivity settings for both pre-alarm and alarm activation shall be automatically individually configurable for both daytime and nighttime operation. Addressable smoke detectors shall be UL listed for automatic sensitivity testing.

Ease of maintenance shall be facilitated by the use of panel based and PC based system diagnostics.

1. The system shall automatically test smoke detector sensitivity, eliminating the need for manual sensitivity testing.
2. Ground fault detection and annunciation shall be by individual module address for supervised input and output devices.
3. System test operation shall be configurable by individual addressable devices, and not disable entire circuits.
4. The system shall be capable of generating a graphical map of connected all addressable devices to aide in circuit troubleshooting.
5. Placement supervision of addressable devices shall couple a device's location (not its address) to the programmed system response.

The system shall provide a one-way multi-channel emergency communication sub-system for the distribution of emergency messages to facility occupants.

The system shall provide a firefighter's telephone sub-system for two-way communications within the facility.

The system shall support CO and security detection devices with appropriate independent annunciation and signal processing.

System panels and annunciators shall utilize configurable message routing and selective event messaging to direct event information only to the required system displays and printers as determined by the event type and location.

1.4.2. FIRE ALARM PERFORMANCE

1.4.2.1. GENERAL REQUIREMENTS

- A. Comply with the provisions of NFPA 72 and the operational requirements of this specification.
- B. The system shall identify all off normal conditions and log each condition into the system as an event.
 - a. The system shall automatically display on the control panel Liquid Crystal Display (LCD) the first (oldest) event of the highest priority by type. The event priority shall be alarm, supervisory, trouble, and monitor.
 - b. The system shall utilize four event queues, and shall not require event acknowledgment by the system operator. Labeled, color coded indicators shall be provided for each type of event queue: alarm - red, supervisory - yellow, trouble - yellow, monitor - yellow. When an unseen event exists for a given type, the indicator shall be lit.
 - c. For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 42 character custom user description.
 - d. The user shall be able to review each event queue by simply selecting scrolling keys (up-down) for the event type.
 - e. New alarm, supervisory, or trouble events shall sound a distinct, silenceable audible signal at the control panel.
 - f. The LCD shall show the number of active alarm, supervisory, trouble and monitor events
 - g. The LCD shall show the system time and the number of active and disabled points in the system.
 - h. Specific input/output devices shall operate in accordance with the alarm, supervisory, trouble, monitor sections that follow and the input/output matrix.
- C. All critical systems, sub-systems and circuits shall be monitored for integrity. System faults shall be annunciated.
- D. Strobes shall be synchronized on each floor.
- E. Batteries shall be sized to support the system for 24 Hrs. of standby operation followed by 15 minutes of

alarm operation at the end of the 24 Hour period.

- F. Off premises reporting of the loss of AC mains power to any system component shall be automatically delayed for a period of time acceptable to the AHJ to reduce traffic at the central monitoring station due to wide-area power failures.
- G. The system shall provide configurable service groups to facilitate "one man" testing of the system based on the physical layout of the building. Each service group shall be capable of supporting any combination of system devices, independent of the circuit on which they are installed. Systems that disable entire circuits, circuits serving multiple floors or fire zones for testing shall not be considered as equal. Activated devices on a service group shall be capable of initiating alternative system test responses to facilitate system maintenance and minimizing occupant disturbances while in test mode.
- H. Event processing and display shall be prioritized as follows:
 - a. Fire alarms
 - b. Supervisory events
 - c. Trouble events
 - d. Monitor events

1.4.2.2. ALARM OPERATION - ECS

Upon the **alarm activation** of any area smoke detector, heat detector, manual pull station, sprinkler waterflow, duct smoke detector, the following functions shall automatically occur:

The system shall remain in the alarm mode until all initiating devices are reset and the fire alarm panel is manually reset and restored to normal.

The internal audible device shall sound at the control panel or command center.

Display the alarm event on the graphical workstation.

The LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer and logged into system history.

Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

The following audio messages and actions shall occur simultaneously:

An evacuation message shall be sounded on all fire floors (zones) immediately for general alarm evacuation. It is the intent of this message to advise occupants hearing this message that they are near danger and should leave the building via the stairs (nearest exit) immediately.

Activate visual strobes on all fire floors immediately for general alarm evacuation. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.

An instructional message shall be sounded in the stairwells instructing occupants to move carefully and quickly down the stairs to exit the building and to exit to a safe floor if you encounter smoke in the stairwell.

An instructional message shall be sounded in the elevator cabs. It is the intent of this message to advise elevator occupants that an emergency exists, the elevator has been directed to the ground floor, and that occupants should quickly exit the building.

An instructional message shall be sounded in the lobby. It is the intent of this message to advise lobby occupants to leave the lobby and clear the area for arriving firefighters.

An instructional message shall be sounded in the concourses connected to the building's lobby. It is the intent of this message to prevent new entries into the lobby by advising occupants not to attempt to enter the lobby of the affected building.

Provide selective paging to each individual floor (zone). In addition to the message/channels detailed above, a dedicated page channel shall be capable of simultaneously providing live voice instructions without interrupting any of the messages listed above shall be provided.

The notification appliance dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

Transmit signal to the building automation system.

Transmit signal to the central monitoring station with point identification.
Activate automatic smoke control sequences.
Activate emergency lighting control.
Activate emergency shutoffs for gas and fuel supplies.
All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
All stairwell/exit doors shall unlock throughout the building.
All self-closing fire/smoke doors held open shall be released.
Transmit alarm text messages to "alpha-numerical" display pagers if required.

IT SHALL BE A REQUIREMENT THAT THE SYSTEM HAVE ALL CODE ALLOWED PARTITIONING.

1.4.2.3. SUPERVISORY OPERATION

Upon supervisory activation of any sprinkler valve supervisory switch, waterflow, duct smoke detector, fire pump off-normal, clean agent fire suppression system trouble, elevator shunt trip supervision, the following functions shall automatically occur:
The internal supervisory event audible device shall sound at the control panel.
Display the event on the graphical workstation and display a pictorial image.
The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
All system activity/events shall be documented on the system printer and logged to system history.
Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
Transmit signal to the central monitoring station with point identification.

1.4.2.4. TROUBLE OPERATION

Upon activation of a trouble condition or signal from any device or internal system integrity monitoring function on the system, the following functions shall automatically occur:

The internal panel audible device shall sound at the control panel.
Display the event on the graphical workstation and display a pictorial image.
The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.

Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not prevent the logging of trouble events to the historical file.

All system activity/events shall be documented on the system printer and logged to system history.

Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.

Transmit a trouble signal to the central monitoring station with point identification.

1.4.2.5. MONITOR OPERATION

Upon activation of any device connected to a **monitor circuit**, the following functions shall automatically occur:

The internal panel audible device shall sound at the control panel.
Display the event on the graphical workstation if provided and display a pictorial image.
The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
Any remote or local annunciator LCD/LED's associated with the monitor circuit shall be illuminated.

1.4.2.6. MONITOR WITH SECURITY OPERATION

Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

The internal panel audible device shall sound at the control panel.
Display the event on the graphical workstation if provided and display a pictorial image.
The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
Any remote or local annunciator LCD/LED's associated with the status monitor circuit be illuminated.

1.5. QUALITY ASSURANCE

1.5.1. QUALIFICATIONS OF SUPPLIER

The system supplier shall have a minimum of 10 years of experience in distribution and service of the proposed equipment brand.

The supplier shall have successfully designed and installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable scope, size and complexity.

The supplier shall have in-house engineering and project management capability consistent with the requirements of this project. The project shall be supervised by personnel certified by NICET as fire alarm Level IV technicians.

The supplier shall employ qualified and manufacturer certified system designers to perform the detailed engineering design, system calculations, for all the system equipment and programming.

The supplier shall produce all panel and equipment drawings, submittals, and operating manuals, as detailed elsewhere in this specification.

The supplier shall be responsible for providing qualified on site representative(s) for coordination of system installation, and final system testing and commissioning in accordance with these specifications.

1.5.2. QUALIFICATIONS OF INSTALLER

Before commencing work, submit evidence showing that the equipment installer has successfully installed systems of the similar scope, type and design as specified.

The contractor/installer shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.

The contractor/installer shall be responsible for retaining qualified and authorized representative(s) of the system manufacturer (The Supplier) specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

The contractor/installer shall employ on staff a minimum of one NICET level II technician or a professional engineer, registered in the State of the installation.

Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

1.6. SUBMITTALS

1.6.1. SUBMITTAL GENERAL

- A. The contractor shall not purchase any equipment for the specified system until the owner has approved the project submittals in their entirety and has returned them to the contractor.
- B. Approved submittals allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications.
- C. Each submittal shall include a detailed list of variations that the submittal may have from the requirements of the contract documents.
- D. The contractor shall provide specific notation on each shop drawing, sample, data sheet, installation manual, etc. submitted for review and approval, of each variation.
- E. Any conflicts in the contract documents and/or with Authority Having Jurisdiction (AHJ) requirements shall be submitted to the owner in writing 7 days prior to bid.
- F. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Architect.

1.6.2. SUBMITTAL BOOKS

Submit for approval no less than three (3) copies of a submittal book to the consulting engineer for review and comment.

Submittal books shall meet the following requirements:

1. Shall be a 3-ring binder with a cover that shows the project address, system type, and contractor.
2. Shall use labeled dividers for major sections.
3. Shall include:
 - a. Cover sheet
 - b. Table of contents
 - i. Provide a list of all types of equipment and components provided. This shall be incorporated as part of a table of contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
 - c. Product data sheets, as detailed elsewhere in this specification
 - d. Provide description of operation of the system (sequence of operation), similar to that provided in Part 2 of this section of the specifications. The description shall be specific to this project, and shall provide individual sequences for every type of alarm, supervisory, or trouble condition, which may occur as part of normal or off-normal system use.
 - e. B-size (black line) reduced shop drawings, as detailed elsewhere in this specification.
 - f. System calculations, as detailed elsewhere in this specification.
 - g. Installation instructions.
 - h. Provide samples of various items when requested.
 - i. Copies of all licenses, documents and certifications, as detailed elsewhere in this specification.

Additional copies may be required at no additional cost to the project.

1.6.3. PRODUCT DATA

System components proposed in this specification shall be UL listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment.

For each product submitted provide the following information:

1. Manufacturer's catalog data, to include material description, agency approvals, operating characteristics, electrical characteristics, dimensions, mounting requirements and accessories.

Product data sheets for system components shall be highlighted to indicate the specific products, features, or functions required to meet this specification.

Alternate or as-equal products submitted under this contract shall provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.

2. Manufacturer's product installation sheets: A copy of the documentation that is required to be shipped with all listed products by UL.

1.6.4. DESIGN CALCULATIONS

Battery Capacity

Provide battery capacity calculations for each power supply that uses batteries for secondary power. Identify all loads. Identify any loads shed during alarm operation. Use the manufacturer's recommended methods and/or forms.

24 VDC NOTIFICATION APPLIANCE CIRCUITS

For each 24VDC NAC, provide worst case voltage drop calculations. The load shall be treated as a lump sum at the end of the circuit. *Worst case power supply terminal voltage shall include all applicable internal power supply losses.* Using 85% of nominal circuit voltage (20.4VDC) shall not be accepted as lowest terminal voltage without manufacturer's published documentation stating there are no internal losses in the power supply.

Audio (Speaker) Notification Appliance Circuits - Interior

The system shall be designed for interior building audibility level of 15 dBA-fast over ambient condition and intelligibility. Intelligibility shall be designed to maintain Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in all areas designated on the drawings to have intelligible audio.

Provide dB loss calculations for all audio (speaker) notification appliance circuits. Circuits shall be designed for no more than 0.5 db loss based on lump-sum load method.

1.6.5. SHOP DRAWINGS

Submit for approval three (3) sets of shop drawings to the consulting engineer for review and comment. Drawings shall be either D-size or E-size blue line drawings and of a sufficient resolution to be completely read. Drawing sets shall be bound. Additional copies may be required at no additional cost to the project.

Contained in the title block of each drawing shall be symbol legends with device counts, wire tag legends, circuit schedules for all addressable and notification appliance circuits, the project name/address, and a drawing description which corresponds to that indicated in the drawing index on the coversheet drawing. A section of each drawing title block shall be reserved for revision numbers and notes.

Shop drawings shall meet the following requirements:

1. Shop drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by the manufacturer of the submitted equipment in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum or Michigan registered Professional Engineer.
2. Coversheet with project name, address and drawing index.
3. General notes drawing with peripheral device back box size information, part numbers, device mounting height information, and the names, addresses, point of contact, and telephone numbers of all contract project team members.
4. Provide device floor plans for all areas served by the fire alarm system. Utilize the CAD Files provided by the consulting engineer in the preparation of the floor plans. Floor plans shall indicate accurate locations for all control and peripheral devices. Drawings shall be NO LESS THAN 1/8-INCH SCALE. If individual floors need to be segmented to accommodate the 1/8" scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner.
 - o All addressable devices shall be shown. Coordinate the device address with the same device shown on the riser diagram.
 - o Identify all notification appliances with a circuit and item number. Coordinate the circuit and item number with the same device shown on the riser diagram.
 - o Show all raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
 - o Areas required to meet intelligibility requirements shall be clearly identified. Wide area mass notification system plot drawings shall identify all project areas that must meet intelligibility requirements as well as environmentally sensitive areas on or off of the project site where system output shall be minimized.
5. Device riser diagram, which individually depict all control panels, annunciators, addressable devices, and notification appliances. Shall include a specific, proposed device description above each addressable device. Shall include a specific, discrete device address that corresponds to addresses shown on the floor plans. Drawings shall provide wire specifications, and wire identification for all conductors depicted on the riser diagram. All circuits shall have identifiers that shall correspond with those required on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
6. Control panel drawing(s) shall show internal component placement and all internal and field terminations. Provide details indicating where conduit connections shall be made to avoid conflicts with internally mounted batteries. For each additional fire alarm panel, a separate drawing which clearly indicated the panel designation, service and location of the control enclosure.
7. Provide typical device wiring diagrams that show all system components, and the respective field wiring. Wire type, gauge, and jacket shall be indicated. When an addressable module is used in multiple configurations for monitoring or controlling equipment, provide a drawing for each application. End-of-line resistors (and values) shall be shown.

8. Provide a fire alarm system function matrix that illustrates alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions.
9. System Calculations as detailed elsewhere in this specification.

Upon receipt of approved drawings from the Authority Having Jurisdiction, the supplier shall immediately forward two sets of drawings to the owner. These drawings shall either be stamped approved or a copy of the letter stating approval shall be included.

1.6.6. CLOSEOUT

Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance.

Project specific operating and maintenance manuals covering the system as installed. The manuals shall contain a description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. A generic instruction and operation manual shall not be acceptable.

Technical literature (manufacturer's data sheets and installation manuals/instructions) for all parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.

Software and Firmware Operational Documentation:

THE END-USER SHALL RETAIN COMPLETE RIGHTS AND OWNERSHIP TO ALL SITE-SPECIFIC SOFTWARE RUNNING IN THE SYSTEM. The fire alarm equipment supplier shall provide hard and soft copies of the software database to the end-user at the end of the warranty period. The database provided shall be useable by any authorized and certified distributor of the product line, and shall include all applicable passwords necessary for total and unrestricted use and modification of the database.

Drawings

Provide "As Built" drawings of record of all the shop drawings used in the installation of the system.

Refer to the Submittals - Shop Drawings section of this specification for drawing requirements.

Record of Completion

System supplier and contractor shall provide a certified test report to verify that the system and all components functioned properly and as intended.

A filled out Record of Completion similar to NFPA 72, 2007 edition figure 4.5.2.1 shall be provided.

Warranty

Provide copies of the warranty documentation as detailed in the Warranty section of this specification.

Service Organization

Provide the name, address and telephone of the authorized factory representative.

Training

Conduct the required training as detailed in the Startup and Commissioning - Training section of this specification.

1.7. HANDLING

1.7.1. DELIVERY AND STORAGE

Receiving

The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.

1.8. WARRANTY

1.8.1. INSTALLATION WORKMANSHIP AND PARTS

The contractor shall warranty the installation and workmanship for one (1) year and all parts for thirty-six (36) months from date of final acceptance. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals. The full cost of maintenance, labor and materials required to correct any defect during the warranty period shall be included in the submittal bid.

During the warranty period, each year the contractor shall perform detector sensitivity testing and provide a report to the owner. If the system is UL Listed to perform automatic detector sensitivity testing without manual intervention, and if a detector falls outside of sensitivity window the system automatically indicates a devices trouble, then this requirement shall be waived. Documentation from UL shall be provided as proof of automatic sensitivity testing operation.

The system supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Provide a telephone response to owner's questions within 4 hours and on-site assistance within 24 hours.

Permit the owner's fire alarm technicians to perform temporary bypasses and emergency repairs on the system without voiding the warranty.

1.9. STARTUP AND COMMISSIONING

1.9.1. TEST AND INSPECTION - FIRE

A. Testing, general

1. In addition to tests required in this section, the contractor shall perform all electrical and mechanical tests required by the equipment manufacturer, the architect and the authority having jurisdiction.
2. The contractor shall perform all testing in occupied facilities at times of day that present the lowest impact and disruption to business and activities. Coordinate all testing in occupied buildings with the building owner's representative to assure that fire alarm system testing does not interrupt operations.
3. All equipment, instruments, tools and labor required to conduct the system tests shall be provided by the installing contractor. At a minimum, the following equipment shall be made available testing:
 - a. Ladders and scaffolds as required to reach all installed equipment.
 - b. Meters for reading voltage, current and resistance.
 - c. Two-way communication devices
 - d. Simulated smoke, heat-producing devices for heat detectors, extension poles for introducing smoke into detectors, as needed.
 - e. Manufacturer's instruments to measure air flow through duct smoke detectors.
 - f. Decibel meter.
 - g. Status and diagnostic software and PC.

B. All testing shall utilize a written acceptance test plan for testing the system components and operation in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the acceptance test plan, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and system programming.

1. The systems operation matrix created by the equipment supplier shall be used to identify each alarm input and verify all associated output functions.

C. The system test plan shall include but not be limited to the following:

1. Visually inspect all wiring.
2. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final acceptance test.
3. System wiring shall be tested to demonstrate correct system response for the following conditions:

- a. Open, shorted and grounded signal line circuits.
 - b. Open, shorted and grounded notification appliance circuits.
- D. System indications shall be demonstrated as follows:
- 1. Correct message content for each alarm input at all system displays.
 - 2. Correct annunciator light for each alarm input at each graphic display.
 - 3. Correct history logging for all system activity.
 - 4. Correct sensitivity for all smoke detection devices. The use of system generated sensitivity reports is acceptable in meeting this requirement.
 - a. Correct signals sent to the Central Monitoring Station.
 - 5. Notification appliances shall be demonstrated as follows:
 - a. All alarm notification appliances actuate as programmed
 - b. Audibility and visibility at required levels. Measure sound levels at 5 ft. above finished floor with the room doors closed.
 - c. For 24VDC NACS, measure and record the voltage at the most remote appliance on each notification appliance circuit, while operating.
 - 6. System control functions shall be demonstrated as follows:
 - a. In accordance with the system operation matrix.
 - 7. System off premises reporting functions shall be demonstrated as follows:
 - a. Correct information received for each alarm and trouble event
 - 8. Secondary power supply (battery) capacity capabilities shall be demonstrated as follows:
 - a. System battery voltages and charging currents shall be measured and recorded at the fire alarm control panels.
 - b. System primary power shall be disconnected for <24 hours>. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of <5 minutes>.
 - c. System primary power shall be restored for forty-eight (48) hours.
 - d. System battery voltages and charging currents shall again be measured and recorded at the fire alarm control panels.
 - 9. Verify the "As Built" record drawings are accurate.

Preliminary Testing

Conduct preliminary tests to ensure that all devices and circuits are functioning properly. Tests shall meet the requirements of the written test plan. Correct any deficiencies, omissions or anomalies and retest the affected devices to assure proper function per the specification.

Acceptance Testing

- 1. A final acceptance test shall not be scheduled until the system manuals are provided to and approved by the owner and the following are provided at the job site:
 - (1) "As Built" record drawings of the system as actually installed
 - (2) A copy of the system operation matrix.
- 2. The acceptance inspector shall use the system "As Built" record drawings in combination with the system operation matrix and the written acceptance test plan during the testing to verify system operation.
- 3. Should the system not perform to the above criteria it shall not be accepted and the contractor

shall correct all deficiencies and shall re-test the system at contractor's expense in the presence of the architect using the same test criteria.

4. The building owner's representative shall witness the final tests.
5. The central monitoring station and/or fire department shall be notified before final test in accordance with local requirements.
6. Operate every installed device to verify proper operation and correct annunciation at control panel.
7. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.

Test Reports

A "Fire Alarm System Record of Completion" per the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in shall be prepared by the Contractor. Submit three (3) copies to the Architect. The report shall include, but not be limited to:

A list of all equipment installed and wired.

Certification that all equipment is properly installed and functions and conforms with these specifications.

Sensitivity settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.

Technician's name, certificate number and date.

1.9.2. TRAINING

The system supplier shall schedule and present a minimum of eight (8) hours of formal site specific instruction for the building owner, detailing the proper operation and maintenance of the installed system.

The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

Copies of all training aids, presentations, etc. shall be left with the owner.

1.10. MAINTENANCE

1.10.1. SPARE PARTS

The contractor shall furnish the following extra material that matches the products installed. Spares shall be packaged with protective covering for storage and identified with labels describing contents.

Glass rods or panels for break glass manual fire alarm stations (if used) - Ten percent of the installed quantity, but no less than two devices.

Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

2. PART 2 - PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS

- A. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of the products specified in this document. These processes shall be monitored under a quality

SECTION 283100

INTEGRATED LIFE SAFETY SYSTEM

Page 13 of 40

assurance program that meets ISO 9000/9001 requirements.

- B. The catalog numbers used are those of Edwards, a UTC Company or equal, and constitute the type and quality of equipment to be furnished. **For local distribution contact Dennis Sargent with Central Fire Protection at (989) 773-5455.**
- C. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall, at the time of bid, list all exceptions taken to these specifications, all variances from these Specifications and all substitutions of operating capabilities or equipment called for in these specifications and forward said list to the engineer. Any such exceptions, variances or substitutions not listed at the time of bid and are subsequently identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination of compliance with these specifications shall rest with the engineer, who, at his discretion, may require proof of performance.
- D. Alternate product submissions shall provide proof of no less than three (3) factory authorized and certified manufacturer's distributors within 75 miles of the project job site. These distributors shall provide installation support, shall have a service organization capable of 24 hour emergency call service and SHALL HAVE BEEN CONTRACTED AND DELIVERED NO LESS THAN FIVE (5) SIMILAR PROJECTS USING THE SUBMITTED PRODUCT OVER THE PAST YEAR. Alternate submissions without the required references shall be rejected.
- E. Alternate product submissions based upon use of a product line considered proprietary in its distribution, design, application software, or ongoing maintenance and repair shall not be acceptable. Proof of a product's non-proprietary nature shall be the burden of the contractor at the time of bid, and shall be in the form of written documentation. The determination of a product's compliance to this requirement shall be exclusively that of the engineer.

All products used shall be of a single manufacturer. All products shall be listed by the manufacturer for their intended purpose. Submission of notification appliances, auxiliary relays, or documentation from other than a single manufacturer shall not be acceptable and will be grounds for immediate disapproval without comment.
- F. Approved Products: All panels and peripheral devices shall be of the standard product of single manufacturer and shall display the manufacturer's name of each component. The catalog numbers specified under this section are those of Edwards, a UTC Climate | Controls | Security Company, and shall constitute the type, product quality, material and desired operating features.

2.2. FIRE ALARM PANEL

2.2.1. GENERAL - FIRE

Overview

All materials, equipment, accessories, devices and other facilities and appurtenances covered by these specifications or noted on the drawings shall be new, best suited for the intended use and shall conform to applicable and recognized standards for their use, and supplied by a single manufacturer. Should any equipment provided under this specification be supplied by a different manufacturer, that equipment shall be recognized compatible by BOTH manufacturers and listed as such as required by Underwriters' Laboratories.

The fire alarm control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control and guard patrol applications. The control panel shall be listed and approved for the application standard(s) as listed in the References section of this specification.

The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any applications can be configured, and modified using software provided by the manufacturer. The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.

The operating controls shall be located in a dead-front steel enclosure behind a locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. All panel modules shall be placement supervised for and signal a trouble if damaged or removed.

System Features

Each control panel shall include the following capabilities:

Supervision of the system electronics, wiring, detection devices and software
Up to 2500 analog/addressable input/output points

SECTION 283100
INTEGRATED LIFE SAFETY SYSTEM

Network connections with up to 63 other control panels and annunciators.
Support multiple dialers (DACTs) and modems
Two communication ports
An internal audible signal with different patterns to distinguish between alarm, supervisory, trouble and monitor events
Support multiple 24 VDC and Audio NACs
User configurable switches and LED indicators to support auxiliary functions
Log up to 1740 chronological events
The ability to download all applications and firmware from the configuration computer at a single location on the fire network
A real-time clock for time stamps and timed event control
Electronic addressing of intelligent addressable devices
Provide an independent hardware watchdog to supervise software and CPU operation
"Dry" alarm, trouble and supervisory relay contacts
Control panel modules shall plug in to a chassis assembly for ease of maintenance
Field wiring shall connect to the panel using removable connectors

User Oriented Features

Each control panel shall include the following user oriented features:

An LCD user interface control/display that shall annunciate and control system functions.
Provide discreet system control switches for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch and details.
A "lamp test" feature shall verify operation of all visual indicators on the panel.
An authorized user shall have the ability to operate or modify system functions including system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
An authorized user shall have the ability to disable/enable devices, zones, actions, timers and sequences.
An authorized user shall have the ability to activate/restore outputs, actions, sequences, and simulate detector smoke levels.
An authorized user shall have the ability to enter time and date, reconfigure an external port for download programming, initiate programming and change passwords.

An authorized user shall have the ability to test the functions of the installed system.
Service groups shall facilitate one-man walk testing. Service/test groups shall be capable of being configured with any combination of addressable devices, independent of SLC wiring. It shall be possible to program alternate device responses when the device's service group is active. Devices not in an active service group shall process all events normally.

Provide internal system diagnostics and maintenance user interface controls to display/report the power, communication, and general status of specific panel components, detectors, and modules.

SLC loop controller diagnostics shall identify common alarm, trouble, ground fault, Class A fault, and map faults. Map faults include wire changes, device type changes by location, device additions/deletions and conventional open, short, and ground conditions. Ground faults on the supervised circuit wiring of remote addressable modules shall be identified by device address.

An authorized user shall have the ability to generate a report history for alarm, supervisory, monitor, trouble, smoke verification, watchdog, and restore activity.

System reports shall provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.

An authorized user shall have the ability to display/report the condition of addressable analog detectors. Reports shall include device address, device type, percent obscuration, and maintenance indication. The maintenance indication shall provide the user with a measure of contamination of a device upon which cleaning decisions can be made.

Programmability

A Windows-based Configuration Utility (CU) shall be used to create the site-specific system programming. The utility shall facilitate programming of any input point to any output point. The utility shall allow customization of fundamental system operations using initiating events to start actions, timers, sequences and logical algorithms.

- Zoning of initiation devices.
- Initiation of events by time of day, day of week, day of year.
- Initiation of events by matrix groups (X-Y coordinate relationships) for releasing systems.
- Initiation of events using OR, AND, NOT and counting functions.
- Prioritizing system events.

- Programmable activation of detector sounder bases by detector, groups of bases, or all bases.
- Directing selected device messages to specific panel annunciators
- Detector sensitivity selection by time of day
- Support of 256 Central Monitoring Station accounts and directing selected device messages to any one of ten Central Monitoring Stations.

The configuration utility shall time and date stamp all changes to the site-specific program, and shall facilitate program versioning and shall store all previous program version data. The utility shall provide a compare feature to identify the differences between different versions of the site-specific program.

The configuration utility shall be capable of generating reports which detail the configurations of all fire alarm panels, addressable devices and their configuration settings including generating electrical maps of the addressable device SLCs.

The configuration utility shall support the use of bar code readers to expedite electronic addressing and custom programming functions.

The fire alarm control panel shall be an Edwards 3-CPU3 and support components in an appropriately sized enclosure.

2.2.2. POWER SUPPLY

System power supply(s) shall be a high efficiency switched mode design providing multiple supervised power limited 24 VDC output circuits as required by the panel and external loads fed by the panel. Initial power supply loading shall not exceed 80% of power supply capacity in order to allow for future system expansion.

Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.

It shall be possible to parallel system power supplies to increase capacity or to provide redundant operation.

Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functionality.

All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.

All standby batteries shall be continuously monitored by the power supply. The power supply shall be able to perform an automatic load test of batteries and indicate a trouble condition if the batteries fall outside a predetermined range. Power supplies shall incorporate the ability to adjust the charge rate of batteries based on ambient temperatures. The power supply shall automatically disconnect the battery before low voltage damages the battery. Low battery and disconnection of battery power supply conditions shall immediately be annunciated as battery trouble and identify the specific power supply(s) affected.

Batteries shall utilize sealed lead acid chemistry. Initial battery capacity shall provide 125% of calculated capacity requirements in order to allow for future system expansion.

All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 70 and NFPA 72. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

The power supply shall be an Edwards 3-PPS/M series.

2.2.3. USER INTERFACE

2.2.3.1. PANEL LCD AND COMMON CONTROLS

The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the facility.

Each fire alarm control panel (system node) shall be capable of supporting a backlit LCD display. The display on each system node shall be configurable to *display* the status of any and/or all combinations of all alarm, supervisory, trouble, monitor, or service group event messages on the network. Each LCD display on the system shall be capable of being programmed to allow *control* functions of any combination of nodes on the entire network. The system shall support both 168 character and 960 character LCD displays on the same network.

The LCD display shall provide separate alarm, trouble, supervisory, and monitor event queues of to minimize operator confusion. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.

The LCD display shall contain the following system status indicators:

- System Power Indicator
- System Test Indicator
- System CPU Fail Indicator
- Ground Fault Indicator
- Disabled Points Indicator
- System Normal Indicator
- System Common Alarm Indicator
- System Common Trouble Indicator
- System Common Supervisory Indicator
- System Common Monitor Event Indicator

The LCD display shall contain the following system switch/indicators:

- System Reset Switch with Indicator
- System Alarm Silence Switch with Indicator
- System Panel Silence Switch with Indicator
- Drill Switch with Indicator
- Alarm Acknowledge Switch with Indicator
- Trouble Acknowledge Switch with Indicator
- Supervisory Acknowledge Switch with Indicator
- Monitor Acknowledge Switch with Indicator

The LCD display shall contain the following system function switches

- System Event Message Queue Scroll Switch.
- Event Details Switch (provides an additional 2000 character message about the device highlighted by the operator.)
- Command Menu Switch
- 10-Digit Keypad with Enter and Backspace switches

The user interface shall provide a backlit LCD that will allow custom event messages of up to 42 characters. The interface shall provide a minimum of eight lines by 21 characters and provide the emergency user hands free viewing of the first and last highest priority events. The last highest priority event shall always display and update automatically. Events shall be automatically placed in one of four easy to access queues. It shall be possible to scroll through and view specific alarm, trouble, supervisory and monitor events separately. Having to scroll through a mixed list of event types shall not be considered as equal. The total number of active and disabled events by type shall be displayed. Visual indication shall be provided of any event type that has not been acknowledged or viewed. It shall be possible to customize the designation of all user interface LEDs and Switches for local language requirements.

Instructional text messages shall support a maximum of 2,000 characters each.

The system 168 character LCD display shall be an Edwards model 3-LCD.

The user interface shall provide a backlit LCD that will allow custom event messages of up to 42 characters. The interface shall provide a minimum of 24 lines by 40 characters and provide the emergency user hands free viewing of the first seven (7) and last highest priority events. The last highest priority event shall always display and update automatically. Events shall be automatically placed in one of four easy to access queues. It shall be possible to view specific alarm, trouble, supervisory and monitor events separately. Having to scroll through a mixed list of event types shall not be considered as equal. The total number of active events by type shall be displayed. Visual indication shall be provided of any event type that has not been acknowledged or viewed. It shall be possible to customize the designation of all user interface LEDs and Switches for local language requirements.

Instructional text messages support a maximum of 2,000 characters each.

The system 960 character LCD display shall be an Edwards model 3-LCDXL1.

2.2.3.2. LEADS AND SWITCHES

A modular series of switches and LED indicators shall be available to customize the fire alarm control panel

operation in accordance with this specification. All LED and switch functions shall be software programmable. Switches shall be configurable for momentary, maintained, toggle, or "exclusive or" operation as required by the application. LEDs shall be configurable for slow flash, fast flash or steady operation. LED/Switch modules shall be capable of mounting in any available fire panel module position. All LED/Switch modules shall be supervised. LEDs shall be available in a variety of colors to facilitate identification from a distance. The LED/Switch modules shall provide ample room for custom function text labels under a protective membrane.

The LED/Switch modules shall be Edwards 3-24x series, 3-12xx series, and 3-6/3S1xxx series devices.

2.2.3.3. AUDIO ANNUNCIATION AND CONTROL

Provide a master one-way emergency audio control unit as part of the main fire alarm control panel. The emergency audio control shall contain a paging microphone and shall be capable of generating and delivering multi-channel audio messages simultaneously over copper and/or fiber media to remote parts of the facility.

All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store up to 32 minutes of pre-recorded audio messages digitally as WAV files. These messages shall be automatically directed to various areas in a facility under program control. The unit shall have the capacity to store up to 200 individual audio messages and to simultaneously play back seven (7) different messages in addition to live page message.

During non-alarm conditions, the control unit shall continuously distribute a default audio message to all amplifiers, providing total audio path supervision. To enhance system survivability, each remote FACP cabinet containing an amplifier shall play the default audio message in the event of a fire AND a control network system failure.

The one-way emergency audio control shall provide control switches to direct live paging messages as follows:

- "All Call" to direct the page messages to all areas in the facility, overriding all other messages and tones.
- "Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
- "Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones.
- "Page to Balance Building" to direct page messages to the areas) in the facility NOT receiving either the evacuation area or alert area messages.
- "Page by Phone" switch to select the firefighter's telephone system as the paging source.

The system shall automatically deliver a preannounce tone of 1000 Hz for three seconds when the emergency operator presses the microphone PTT key. A 'ready to page' LED shall flash during the preannounce phase, and turn steady when the system is ready for the user's page delivery. The system shall include a page deactivation timer which activates for 3 seconds when the emergency user release the microphone talk key. Should the user subsequently press the microphone key during the deactivation period a page can be delivered immediately. Should the timer complete its cycle the system shall automatically restore emergency signaling and any subsequent paging will be preceded by the pre-announce tone. A VU display shall indicate voice level to the emergency operator.

The one-way audio control unit shall be capable of supporting up to 64 remote microphone inputs and a line level audio input.

The fire alarm control panels shall support remote cabinets with zoned amplifiers to receive, amplify and distribute messages through speakers over supervised circuits.

The master one-way emergency audio control unit shall be an Edwards 3-ASU.

2.2.3.4. FIREFIGHTER'S TELEPHONE SYSTEM

Provide a fully integrated two-way voice firefighter's telephone system between the main fire alarm panel and remote firefighter's phone jacks and firefighters' telephone (warden) stations, as located on the drawings.

The firefighter's telephone system shall provide 4-state supervised (opens, shorts, ground faults) two-way communications between remotely located phones and the main fire alarm panel.

At the main fire panel, the system shall include an 8-line 160 character LCD display to show the operator the identity and location of up to 5 connected and 20 incoming calls. Each remote telephone shall be annunciated and connected independently using a dedicated addressable control module. The control unit shall provide the ability to individually select and display each two-way voice communication circuit, supporting up to five (5) remote

telephones in simultaneous two-way voice "conference call" communications.

Plugging a handset into a firefighter's phone jack or taking any phone off-hook shall display call-in location information in full English language up to 20 characters, without the need for individual LEDs and switches per telephone station. A distinctive audible device shall also sound at the main fire panel. The system shall also generate a ring tone in the remote phone to signify to the calling party that the main fire panel is displaying the incoming call.

The emergency user shall connect to a call by taking the master phone off-hook, scrolling the cursor to the desired call's ID message displayed on the LCD, and pressing the 'connect' switch, which shall silence the incoming call sounder, and complete a two-way communication path between the master phone and the remote phone.

To terminate a call, the operator shall scroll the LCD cursor over the connected callers' ID message, and press the 'disconnect' switch.

When all handsets have been unplugged and all firefighters' phones have been placed in the on-hook position, the system shall return to normal and restore all integrity monitoring functions.

It shall be possible to configure any firefighter's telephone to make emergency page announcements through the one-way audio paging system, without affecting the simultaneous alarm messages to other areas in the building.

The firefighter's telephone system shall be an Edwards model 3-FTCU

2.2.3.5. SYSTEM PRINTER

The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. The printer shall be capable of serial or parallel communications protocol. The communications speed for RS-232 communications protocol shall be adjustable from 300 to 9600 Baud.

The printer output shall include the type of event, the circuit or device reporting including address, date, and event time. Event restoral conditions shall also be printed, including address, date, and event time.

In the event that the printer is off-line when an event is received, a panel buffer shall retain the data and it shall be printed when the printer is restored to service.

The system printer shall be an Edwards PT-1S.

2.2.3.6. REMOTE MICROPHONE

Remote Microphone

Remote microphones shall be located as indicated on the drawings.

The remote microphone shall facilitate live page announcements over the ACU/FACP system from locations distant from the ACU/FACP. It shall be possible to connect up to 63 remote microphones to an ACU/FACP.

The remote microphone shall feature a Push-to-Talk switch; local and remote page active LEDs, and a trouble LED.

The remote microphone shall operate on filtered-regulated 24 VDC power derived from the panel power supply. Power shall be supplied directly from the ACU/FACP or listed auxiliary power supply, ensuring a reliable and monitored power source.

The remote microphone shall be an Edwards 3-REMIC series.

2.2.3.7. REPORTS

The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.

The system shall provide a report that gives a sensitivity listing of all detectors that have less than 80% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.

When addressable CO detectors are installed, performing a "sensitivity" check from the panel shall report the approximate number months of sensor life remaining.

The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in

the system, or any given analog/addressable device loop within any given panel.

The system shall provide a report that gives a chronological listing of at least the last 1000 system events.

The system shall provide a listing of all of the firmware revision listings for all of the installed components in the system.

2.2.4. SIGNALING LINE CIRCUITS

2.2.4.1. FIRE NETWORK WIRING

The network inter panel wiring shall be Class B. The network media shall be copper except where fiber optic cable is specified on the drawings.

The system supplied under this specification shall utilize node to node, direct wired peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors and input/output modules as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.

When a network is wired in a Class B configuration, a single break or short on the network wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined databases. When wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages.

The copper network interface shall be an Edwards 3-RS485 series.

The fiber optic network interface shall be an Edwards 3-FIBMB2 with <single mode> <multi-mode> fiber optic transceivers.

2.2.4.2. EST3 SYSTEM

The signaling line circuit connecting panels/nodes to intelligent addressable devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class B (style 4). All signaling line circuits shall be supervised and power limited.

When the addressable devices on a signaling line circuit cover more than one designated fire/smoke compartment, a wire-to-wire short on the circuit shall not affect the operation of the addressable devices in other fire/smoke compartments.

Each SLC shall support 125 addressable detector addresses and 125 module addresses. The SLC shall support 100% of all addressable devices in alarm and provide support for a 100% compliment of detector isolator bases. Initial circuit loading shall not exceed 80% in order to allow for future system expansion.

T-taps (branching) shall be permitted on Class B circuits. Where possible, the devices installed at the end of each branch should be easily accessible for troubleshooting, e.g. a pull station at normal mounting height.

The addressable device SLC module shall be UL Listed for use with code compliant, electrically sound existing wiring.

Each intelligent addressable device shall transmit information about its location with respect to other devices on the circuit. This information shall be used to create an "As-Built" wiring diagram as well as provide enhanced supervision of a device's physical location. The device message and programmed system output function shall be associated with the device's location on the SLC circuit location and not a device address.

The SLC module shall allow replacement of "same type" devices without the need to address and reload the "location" parameters on replacement device.

The SLC/Panels shall notify the user when programmed devices are detected on the SLC circuit. The SLC/Panels shall notify the user when the wrong device type is installed at a location configured for a different device type on the SLC circuit.

Should an SLC Controller CPU fail to communicate, the SLC circuit shall go into the stand-alone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during stand-alone mode to enhance system integrity.

The addressable device signaling line circuit module shall be an Edwards 3-SDDC1 series.

2.2.5. NOTIFICATION APPLIANCE CIRCUITS

2.2.5.1. NOTIFICATION APPLIANCE CIRCUITS

General

All notification circuits shall be supervised and power limited. Non-power limited circuits are not acceptable. All notification appliance circuits shall be Class B (Style "Y"). Initial circuit loading shall not exceed 80% in order to allow for future system expansion.

24 VDC Notification Appliance circuits

Notification appliance circuits shall have a minimum circuit output rating of 2 amps @ 24 VDC

24VDC NACs shall be polarized and provide both strobe synchronization and a horn silence signals on a single pair of wires.

Audio Notification Appliance Circuits

Audio notification appliance circuits shall be polarized and have a minimum circuit output rating of 50 watts @ 25V audio, and 35 watts @ 70V audio.

2.2.5.2. AUDIO AMPLIFIERS

Each audio power amplifier shall have integral audio signal de-multiplexers, allowing the amplifier to select any one of eight digitized audio channels as directed by system programming.

Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall provide a selectable 25/70 Vrms output, suitable for connection to emergency speakers.

To enhance system survivability in the event of a total loss of audio data communications, all amplifiers shall default to the local "EVAC" tone generator channel. If the local panel has an alarm condition, then all amplifiers will sound the EVAC message on their speaker circuits. In the event of a loss of the fully digitized, multiplexed audio riser data, the audio amplifiers shall automatically default to an internally generated alarm tone which shall sound a 3-3-3 temporal pattern.

Amplifiers shall also include a 24 VDC notification appliance circuit rated at 24Vdc @ 3.5A for connection of visible (strobe) appliances. This circuit shall be fully programmable.

Provide as minimum, one twenty (20) watt audio amplifier per paging zone. Initial amplifier loading shall not exceed 80% in order to allow for future system expansion. Calculations shall assume each speaker is connected at one (1) watt.

Audio amplifiers shall be Edwards 3-ZA series devices.

2.2.6. INITIATING DEVICE CIRCUITS

2.2.6.1. INITIATING DEVICE CIRCUITS

Conventional (2-wire) initiating device circuits monitoring manual fire alarm stations, smoke and heat detectors, waterflow switches, valve supervisory switches, fire pump functions, and air pressure supervisory switches shall be Class B (Style "A" or "B").

Initiating device circuits shall be configurable for latched or non-latched operation and configurable to initiate alarm, supervisory or monitor events.

End-of-line resistors for conventional initiating device circuits shall be covered with insulated tubing, terminated with ring lugs and display a UL label.

2.2.7. Off Premises Communications

2.2.7.1. DACT

The system shall provide off premises communications capability using a Digital Alarm Communications Transmitter (DACT) for sending system events to multiple Central Monitoring Station (CMS) receivers over conventional telephone lines.

The system shall provide the CMS(s) with point identification of system events using 4/2, Contact ID (SIA DC-05) or SIA DCS protocols. The system shall also be capable of transmitting an alphanumeric system activity message, by event, to a commercial paging system provided by the owner, using TAP Pager protocol and an internal V.32BIS or greater 14.4Kbaud modem.

The dialer shall support up to 255 individual accounts and to send account information to eight (8) different receivers, each having a primary and secondary telephone access number. System events shall be capable of being directed to one or more receivers depending on event type or location as specified by the system design.

In the event of a fire alarm panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

The owner shall arrange for two (2) dedicated loop-start phone lines to be terminated using two RJ31X jacks within 5 ft of the main fire alarm control panel.

The DACT shall be an Edwards 3-MODCOM(P).

2.3. REMOTE BOOSTER POWER SUPPLY

2.3.1. REMOTE BOOSTER POWER SUPPLY

Install Remote NAC Power Supplies (boosters) at the locations shown on the drawings, as required, to minimize NAC voltage drops. Remote NAC power supplies shall be treated as peripheral NAC devices and shall not be considered fire alarm control units.

The NAC power supplies shall be fully enclosed in a surface mounted steel enclosure with hinged door and cylinder lock, and finished in red enamel. Door keys shall be the identical to FACP enclosure keys. The enclosure shall have factory installed mounting brackets for additional UL listed fire alarm equipment within its cabinet. Enclosures shall be sized to allow ample space for interconnection of all components and field wiring, and up to 10AH batteries. The enclosure shall have provisions for an optional tamper switch. All FACP addressable control modules required to initiate the required NAC power supply output functions shall be installed within the NAC power supply enclosure

Remote NAC power supply *input* circuits shall be configurable as Class B supervised inputs or for connection to any 6 to 45 VDC initiation source.

Remote booster power supplies shall provide four (4) synchronized Class B supervised or two (2) Class A, power limited, 24VDC filtered and regulated Notification Appliance Circuits (NACs). Each NAC output shall be configurable as a continuous 24Vdc auxiliary power output circuit. The booster power supply shall be capable of a total output of 10 amps.

The power supply NACs shall be configurable to operate independently at any one of the following rates: continuous synchronized, or 3-3-3 temporal. It shall be possible to configure the NACs to follow the main FACP NAC or activate from intelligent addressable synchronized modules. All visible NACs within the facility shall be synchronized.

Upon failure of primary AC power, the remote power supply shall automatically switch over to secondary battery power without losing any system functions. It shall be possible to delay reporting of an AC power failure for up to 6 hours. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as locally as battery trouble. All power supply trouble conditions (DC power failure, ground faults, low batteries, and IDC/NAC circuit faults) shall identify the specific remote power supply affected at the main FACP. All power supply trouble conditions except loss of AC power shall report immediately. Interconnecting NAC Booster power supplies in a manner which prevents identification of an individual power supply trouble shall not be considered as an equal.

The remote booster power supply shall be capable of recharging up to 24AH batteries to 70% capacity in 24 hours maximum. Batteries provided shall be sized to meet the same power supply performance requirements as the main FACP, as detailed elsewhere in this specification.

All AC power connections shall be to the building's designated dedicated emergency electrical power circuit. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each remote NAC power supply the disconnect serves.

The remote NAC power supplies shall be Edwards model BPS/APS series devices.

2.4. ANNUNCIATORS

2.4.1. REMOTE ANNUNCIATOR

Provide a UL864 listed semi-flush mounted remote annunciator at the location(s) shown on the drawings.

The annunciator shall utilize standard fire alarm user interface components to provide the ability to operate the Fire Alarm Control Panel functions from alternate locations within the building. The annunciator shall be capable of receiving the same event information and issuing the same system commands as the FACP to which it is connected, as specified in the functional matrix elsewhere in this specification.

The following common indicators and controls shall be provided on the annunciator.

The annunciator shall include an integral fire alarm LCD text annunciator. Annunciator Power, Alarm, Supervisory, Trouble, and Signal Silenced LEDs; System Reset, Silence, Trouble Silence, Drill and Lamp Test push buttons.

The remote annunciator shall be equipped with a key locked see-through door mounting. The annunciator shall be powered by a battery backed up nominal 24 VDC power source.

The fire alarm remote annunciator shall be Edwards 3-ANN series annunciator.

2.5. PERIPHERAL COMPONENTS

2.5.1.1. ADDRESSABLE DETECTORS

2.5.1.1.1. GENERAL

General Requirements for Intelligent Addressable Heat, Smoke and CO Detectors

Each detector shall contain an integral microprocessor which shall determine if the device is normal, in alarm, or has an internal trouble. The microprocessor's non-volatile memory shall permanently store the detector's serial number, device type and system address. It shall be possible to address each intelligent device without the use of switches. Devices requiring switches for addressing shall not be considered as equal. Memory shall automatically be updated with the hours of operation, last maintenance date, number of alarms and troubles, time of last alarm, and analog signal patterns for each sensing element just before the last alarm.

Each detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

Each addressable detector on the Signaling Line Circuit (SLC) shall transmit information regarding its location with respect to other intelligent devices on the signaling line circuit to the control panel, creating an "As-Built" circuit map. The circuit mapping function shall provide location supervision of all intelligent devices on the signaling line circuit. An intelligent detector's programmed system response functions shall be associated with the detector's actual *location* on the signaling line circuit and *not with the detector's address*. After system commissioning, detectors improperly installed in the wrong location shall function according to the mapped programmed response for its *location* on the circuit, not its detector's address.

Two status LEDs shall be provided on each detector. A flashing green LED shall indicate normal operation; flashing RED shall indicate the alarm state. A steady RED and steady GREEN shall indicate alarm state when in the stand-alone mode. LEDs shall be visible from any direction.

The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced, without the need for reprogramming. System shall display an off-normal condition until the proper detector type is installed or a change in the device type profile has been made.

Detectors shall be rated for operation in the following environment unless specifically noted:

- Temperature: 32°F to 120°F (0°C to 49°C)
- Humidity: 0-93% RH, non-condensing

Detectors with addressing components in the base shall not be considered as equal.

The intelligent detectors shall be Edwards Signature Series devices.

2.5.1.1.2. PHOTO-HEAT-CO

Provide analog/addressable combination photoelectric smoke-heat and carbon monoxide (CO) detectors at the locations shown on the drawings.

The combination smoke-heat & CO detector shall provide two independent signals (fire & CO) to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when smoke or heat is detected or temporal 4-4-4-4 when CO is detected. Detectors that transmit a common signal for both fire and CO alarms shall not be considered as equal. The detector shall be listed under standards UL-268 and UL-2075.

Each smoke-heat detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.

Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

The smoke chamber shall be UL listed for field replacement.

Three low mass thermistors shall act as fixed temperature 130 to 140 °F (54 to 60 °C) heat sensors, contributing along with the photo sensor to the fire alarm algorithm.

The electro-chemical CO sensor shall generate a CO alarm in compliance with the UL-2034 requirements. The sensor shall have a nominal six-year life. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Sensors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal. Performing a "sensitivity" check from the panel shall report the approximate number months of CO sensor life remaining.

Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality. The CO sensor board shall be UL listed as field replaceable. Replacement of the CO sensor shall not require any field calibration.

The Combination photoelectric smoke-heat & CO detector shall be an Edwards SIGA2-PHCOS.

2.5.1.1.3. PHOTO-CO

Provide analog/addressable combination photoelectric smoke and carbon monoxide (CO) detectors at the locations shown on the drawings.

The combination smoke and CO detector shall provide two independent signals (smoke & CO) to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when smoke is detected or temporal 4-4-4-4 when CO is detected. Detectors that transmit a common signal to the control panel for both smoke and CO alarms shall not be considered as equals. The detector shall be listed under standards UL-268 and UL-2075.

Each smoke detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.

Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty

fault signal when 100% or greater compensation has been used.

The smoke chamber shall be UL listed for field replacement.

The electro-chemical CO sensor shall generate a CO alarm in compliance with UL-2034 requirements. The sensor shall have a nominal six-year life. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Sensors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal. Performing a "sensitivity" check from the panel shall report the approximate number months of CO sensor life remaining.

Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality. The CO sensor board shall be UL listed as field replaceable. Replacement of the CO sensor shall not require any field calibration.

The Combination photoelectric smoke & CO detector shall be an Edwards SIGA2-PCOS.

2.5.1.1.4. HEAT-CO

Provide analog/addressable combination heat and carbon monoxide (CO) detectors at the locations shown on the drawings.

Low mass thermistors shall provide a 135°F (57°C) fixed-temperature heat sensing for the detection of heat due to fire. The sensor monitors the temperature of the surrounding air and determines whether an alarm should be initiated.

The combination heat and CO detector shall provide two independent signals (fire & CO) to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when heat is detected or temporal 4-4-4-4 when CO is detected. Detectors that transmit a common signal to the control panel for both heat and CO alarms shall not be considered as equals. The detector shall be listed under standards UL-521 and UL-2075.

The electro-chemical CO sensor shall generate a CO alarm in compliance with UL-2034 requirements. The sensor shall have a nominal six-year life. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Sensors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal. Performing a "sensitivity" check from the panel shall report the approximate number months of CO sensor life remaining.

Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality. The CO sensor board shall be UL listed as field replaceable. Replacement of the CO sensor shall not require any field calibration.

The Combination heat & CO detector shall be an Edwards SIGA2-HCOS.

2.5.1.1.5. PHOTO-HEAT

Provide analog/addressable combination photoelectric smoke-heat detectors at the locations shown on the drawings.

When mounted in a sounder base, the detector shall be capable of initiating a temporal 3-3-3 when smoke or heat is detected.

Each smoke-heat detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.

Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

Three low mass thermistors shall act as fixed temperature 130 to 140 °F (54 to 60 °C) heat sensors, contributing along with the photo sensor to the fire alarm algorithm.

The Combination photoelectric smoke-heat detector shall be an Edwards SIGA-PHS.

2.5.1.1.6. PHOTOELECTRIC

Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings.

When mounted in a sounder base, the detector shall initiate a temporal 3-3-3 when smoke is detected.

The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.

Each smoke detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.

Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

The photoelectric smoke detector shall be an Edwards SIGA-PS.

2.5.1.1.7. DUCT SMOKE

Provide intelligent low profile photoelectric duct smoke detectors / remote test switches at the locations shown on the drawings.

The intelligent duct smoke detector shall operate in ducts having from 100ft/min to 4,000ft/min air velocity. The detector shall be suitable for operation over a temperature range of -20 to 158F° and offer a harsh environment gasket option. The detector shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten (10) feet. Design of the detector shall permit sampling tube installation from either side of the detector and permit sampling tube installation in 45- degree increments to ensure proper alignment with duct airflow. Drilling templates and gaskets to facilitate locating and mounting the housing shall be provided.

The intelligent duct smoke detector shall obtain information from a photoelectric sensing element. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel

Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

The intelligent duct smoke detector shall provide a form "C" auxiliary alarm relay rated at 2amps @ 30Vdc. The position of the relay contact shall be supervised by the control panel software. Operation of the relay shall be controlled either by its respective detector processor or under program control from the control panel as required by the application. Detector relays not capable of programmed operation independent of the detector's state shall not be considered as equal. The detector shall be equipped with a local magnet-activated test switch.

Each duct detector shall be installed and testing in accordance with manufacturer's instructions, including pressure differential and, velocity testing. Test results shall be submitted to the owner.

Remote test switches/LED indicators shall be provided below the detector on the ceiling to indicate location of the detector in non-mechanical areas, at locations indicated on the drawings.

The Intelligent Photoelectric Duct Smoke Detector shall be an Edwards model SIGA-SD.

The remote key operated test switch / LED shall be a Edwards model SD-TRK

2.5.1.1.8. DUCT MOUNTING PLATE

Where addressable smoke detectors are directly mounted on a low velocity ducts up to 3 ft (0.91m) high x 3 ft (0.91m) wide, provide factory mounting plate assemblies to facilitate mounting the detectors. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish. The detector mounting plate shall support an addressable detector along with a standard, relay or isolator detector mounting base.

The detector mounting plate shall be an Edwards SIGA-DMP.

2.5.1.1.9. FIXED HEAT

Provide intelligent fixed temperature heat detectors at the locations shown on the drawings.

The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The detector shall utilize a low mass thermistor heat sensor and operate at a nominal fixed temperature alarm point rating of 135°F (57°C). The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of thermistor data. Systems using central intelligence for alarm decisions shall not be considered as equal.

The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and also be suitable for wall mount applications.

The Intelligent fixed temperature detector shall be an Edwards SIGA-HFS.

2.5.1.1.10. RATE OF RISE

Provide intelligent combination fixed temperature / rate-of-rise heat detectors at the locations shown on the drawings.

The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The detector shall utilize a low mass thermistor heat sensor and operate at a nominal fixed temperature alarm point rating of 135°F and at a temperature rate-of-rise alarm point of 15°F per minute. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of thermistor data. Systems using central intelligence for alarm decisions shall not be considered as equal.

The heat detector shall be rated for ceiling installation at a minimum of 70 ft centers and also be suitable for wall mount applications.

The Intelligent combination fixed temperature / rate-of-rise heat detector shall an Edwards SIGA-HRS.

2.5.1.1.11. CO

Provide addressable carbon monoxide (CO) detectors at the locations shown on the drawings.

The CO detector shall provide a signal to the control panel for programming system responses. When mounted in a sounder base, the detector shall be capable of initiating a temporal 4-4-4-4 signal when CO is detected. The detector shall be listed under standard UL-2075.

The electro-chemical CO sensor shall generate a CO alarm in compliance with UL-2034 requirements. The sensor shall have a nominal six-year life. Performing a "sensitivity" check from the panel shall report the approximate number months of sensor life remaining. When the sensor approaches the end of its useful life, it shall transmit a maintenance condition to the control panel, indicating the CO sensor board replacement is required. Only when the sensor is no longer operational shall a trouble condition be sent to the control panel. Detectors that transmit a common trouble indication for both sensor end-of-life and other causes of detector trouble shall not be considered as equal.

Placing the CO detector in test mode shall facilitate the use of direct injection of small quantities of CO to check detector functionality. The CO sensor board shall be UL listed as field replaceable. Replacement of the CO sensor shall not require any field calibration.

The CO detector shall be an Edwards SIGA2-COS.

2.5.1.1.12. STANDARD BASE

Provide standard detector bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, European BESA or 1-gang box.

The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.

The base shall contain no active electronics and support all Signature series detector types.

The base shall be capable of supporting a Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

Removal of the respective detector shall not affect communications with other detectors.

The standard addressable detector base shall be an Edwards SIGA-SB or SB4.

The remote LED indicator shall be an Edwards SIGA-LED

2.5.1.1.13. RELAY BASE

Provide relay detector bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, European BESA or 1-gang box; at the locations shown on the drawings.

The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.

The base shall contain no electronics and support all Signature series detector types.

Removal of the respective detector shall not affect communications with other detectors.

The relay base shall meet the following requirements:

- The relay shall be a bi-stable type and selectable for normally open or normally closed operation.

- The position of the relay contact shall be supervised.

- The operation of the base relay shall be configurable for control by its respective detector or for independent programmable control from the fire alarm panel. Relay bases not configurable for detector or panel operation shall not be considered equal.

- The base relay shall provide form "C" contacts with a minimum rating of 1 amp @ 30 Vdc and be listed for pilot duty.

The standard addressable relay detector base shall be an Edwards SIGA-RB or RB4.

2.5.1.1.14. SOUNDER BASE

Provide audible detector mounting bases suitable for mounting on a North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA or 1-gang box; at the locations shown on the drawings.

The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.

Removal of the respective detector shall not affect communications with other detectors.

The audible base shall support all detector types and shall be capable of single or group operation.

The audible base shall emit a temporal 3-3-3 fire alarm tone when smoke or heat has been detected. The audible base shall emit a temporal 4-4-4-4 CO alarm tone when CO has been detected. The outputs shall be configurable for low or high output by moving a reversible jumper. The system shall be UL2017 listed for dual signaling for this purpose.

The audible bases shall provide a UL-268 reverberant room sound output of 90.8 dBA at 10ft (3m) for temporal 3-3-3 fire alarm and 84.1 dBA at 10 ft.(3m) for temporal 4-4-4-4 CO alarm.

The detector sounder base shall be an Edwards SIGA-AB4GT.

2.5.1.1.15. ISOLATOR BASE

Provide isolator detector bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, European BESA or 1-gang box; at the locations shown on the drawings.

The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.

The base shall support all Signature series detector types.

Isolator bases shall limit number of modules or detectors that may be rendered inoperative by short-circuit fault on SLC loop segment or branch. In the event the Class A signaling line circuit on which the isolator bases are installed

SECTION 283100

INTEGRATED LIFE SAFETY SYSTEM

Page 28 of 40

is shorted, each base shall open the SLC. Isolator bases shall then sequentially reconnect the isolated circuit segments until only the segment with the short is left out of the circuit, leaving the balance of the circuit operational.

The Isolator Base shall be an Edwards SIGA-IB or SIGA-IB4.

2.5.1.1.16. SMOKE DETECTOR GUARDS

Smoke detector guards shall be installed at the locations shown on the drawings.

The guards shall be UL tested and listed by for use with the smoke detectors they protect. Guard design shall not affect the detector operating sensitivity and shall not reduce the listed detector spacing.

The design of the guard shall provide physical protection for the detector while preventing looped items from hanging on the guard when wall mounted or being threaded through the guard.

The guards shall be constructed of 16-gauge steel with a baked white finish to match the detectors. Tamperproof mounting hardware shall be provided.

The Smoke Detector Guards shall be Edwards SIGA-DG.

2.5.1.2. MANUAL STATIONS

2.5.1.2.1. SINGLE ACTION SINGLE STAGE

Provide addressable single action, single stage fire alarm stations at the locations shown on the drawings.

The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers. If indicated as surface mounted, provide manufacturer's surface back box.

The fire alarm station shall be of metal construction, shall be finished in red with silver "PULL IN CASE OF FIRE" lettering, shall show visible indication of operation and incorporate an internal toggle switch.

The manual pull station will have an addressable module integral to the unit.

The station shall be reset using a common tool.

Manual pull stations that initiated an alarm condition when opening the unit are not acceptable.

The addressable single action, single stage fire alarm station shall be an Edwards SIGA-270

2.5.1.3. MODULES

2.5.1.3.1. GENERAL

Intelligent addressable multifunction modules shall be provided at the locations shown on the drawings to provide the specific system input and output functions described by the operation section and functional matrix found elsewhere in this specification.

The operation of multifunction modules shall be software configurable at the site to meet operational conditions, and may be changed at any time by download changes from the control panel. The intelligent multifunction modules shall utilize electronic addressing. Modules using rotary or DIP switches, memory chips and / or jumpers for addressing shall not be considered as equal.

Each intelligent multifunction module on the Signaling Line Circuit (SLC) shall transmit information regarding its location with respect to other intelligent devices on the signaling line circuit to the control panel, creating an "As-Built" circuit map. The circuit mapping function shall provide location supervision of all intelligent devices on the signaling line circuit. An intelligent device's programmed system response functions shall be associated with the device's actual *location* on the signaling line circuit and *not with the device's address*. After system commissioning, devices improperly installed in the wrong location shall function according to the mapped programmed response for its *location* on the circuit, not its device address.

All input /output status decisions shall be made by the microprocessor within the module. Communications with a control panel shall not be required in order for the module to identify off-normal input/output conditions. Modules with supervised input or output circuits shall be capable of identifying ground fault conditions down to the module address level.

Each module shall be equipped with two (2) diagnostic indicators; a green LED to confirm communications and a

SECTION 283100

INTEGRATED LIFE SAFETY SYSTEM

Page 29 of 40

red LED to display active status. LEDs shall be visible through the finished cover plate. The module shall be capable of storing a unique serial number and up to 24 diagnostic codes, hours of operation, number of alarms and troubles, and time of last alarm in its memory which can be retrieved for troubleshooting.

Modules shall be rated for operation in the following environment:

- Temperature: 32°F to 120°F (0°C to 49°C)
- Humidity: 0-93% RH, non-condensing

Where multiple modules are mounted in close proximity to each other, plug-in modular versions of the modules and motherboards shall be available to minimize field wiring and facilitate troubleshooting.

The addressable multifunction modules shall be Edwards Signature Series devices.

2.5.1.3.2. ONE INPUT MONITOR

Provide addressable single input multifunction modules at the locations shown on the drawings.

The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.

Each module shall provide one (1) supervised Class B input circuit configurable as one of the following "personalities."

1. Normally-Open Alarm Latching (for alarm initiation applications)
2. Normally-Open Alarm Delayed Latching (for waterflow switch applications)
3. Normally-Open Active Non-Latching (for limit switch and monitor applications)
4. Normally-Open Active Latching (for tamper switch and supervisory applications)

Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuit, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

The Intelligent Single Input Module shall be an Edwards SIGA-CT1.

2.5.1.3.3. TWO INPUT MONITOR

Provide addressable dual input multifunction modules at the locations shown on the drawings.

The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.

Each module shall provide two (2) supervised Class B input circuit configurable as one of the following "personalities."

1. Normally-Open Alarm Latching (for alarm initiation applications)
2. Normally-Open Alarm Delayed Latching (for waterflow switch applications)
3. Normally-Open Active Non-Latching (for limit switch and monitor applications)
4. Normally-Open Active Latching (for tamper switch and supervisory applications)

Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuits, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

The Addressable Dual Input Module shall be an Edwards SIGA-CT2.

2.5.1.3.4. NOTIFICATION CIRCUIT

Provide addressable notification appliance circuit modules at the locations shown on the drawings.

The module shall be suitable for mounting in North American 2½" (64mm) deep 2-gang boxes and 1½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.

The addressable NAC module shall provide one (1) supervised Class B notification appliance circuit.

The NAC control module shall be configurable for the following operations:

- 24 VDC synchronized NAC circuit, 2 amps @ 24 VDC.
- Audio notification circuit 25Vrms @ 50 watts or 70 Vrms @ 35 watts
- Firefighter's Telephone control with ring tone

The addressable notification appliance circuit module shall be an Edwards SIGA-CC1(S) or MCC1(S)

2.5.1.3.5. RELAY

Provide addressable control relay modules at the locations shown on the drawings.

The module shall be suitable for mounting on a North American 2 1/2" (64mm) deep 1-gang box or 1 1/2" (38mm) deep 4" square box with 1-gang covers.

The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware. The relay coil shall be magnetically latched to reduce wiring and ensure 100% of the relays on the SLC can be energized at same time.

The addressable control relay module shall be an Edwards SIGA-CR or MCR.

2.5.1.3.6. WATERFLOW-TAMPER

Provide addressable dual input waterflow / tamper modules at the locations shown on the drawings.

The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers.

Each module shall provide two (2) supervised Class B input circuit configured as:

1. Normally-Open Alarm Delayed Latching for waterflow switch applications.
2. Normally-Open Active Latching for tamper switch and supervisory applications.

Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuits, to the control panel. Modules or without individual ground fault detection identification capability shall not be considered as equal.

The Addressable Dual Input Module shall an Edwards SIGA-WTM.

2.5.1.3.7. ISOLATION MODULE

Provide addressable isolator modules at the locations shown on the drawings.

The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 1-gang covers.

In the event the Class A signaling line circuit on which the intelligent isolator module is installed is shorted, each module shall open the SLC. Isolator modules shall then sequentially reconnect the isolated circuit segments until only the segment with the short is left out of the circuit, leaving the balance of the circuit operational.

The addressable Isolator Module shall be an Edwards SIGA-IM.

2.5.1.3.8. UNIVERSAL MODULES

Provide intelligent universal Class A/B multifunction modules at the locations shown on the drawings.

The module shall be suitable for mounting on North American 2 1/2" (64mm) deep 2-gang boxes and 1 1/2" (38mm) deep 4" square boxes with 2-gang covers.

Each universal module shall be configurable as one of the following "personalities."

1. Two (2) supervised Class B Normally-Open Alarm Latching. (for alarm initiation applications)
2. Two (2) supervised Class B Normally-Open Alarm Delayed Latching. (for waterflow switch applications)
3. Two (2) supervised Class B Normally-Open Active Non-Latching. (for limit switch and monitor applications)
4. Two (2) supervised Class B Normally-Open Active Latching. (for tamper switch and supervisory applications)
5. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc. (for circuit control applications)
6. One (1) supervised Class A Normally-Open Alarm Latching. . (for alarm initiation applications)
7. One (1) supervised Class A Normally-Open Alarm Delayed Latching. . (for waterflow switch applications)
8. One (1) supervised Class A Normally-Open Active Non-Latching. (for limit switch and monitor applications)

- 9. applications)
One (1) supervised Class A Normally-Open Active Latching. . (for tamper switch and supervisory applications)
- 10. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified. (for alarm initiation applications)
- 11. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified. (for alarm initiation applications)
- 12. One (1) supervised Class A 2-wire Smoke Alarm Verified (for alarm initiation applications)
- 13. One (1) supervised Class B 2-wire Smoke Alarm Verified (for alarm initiation applications)
- 14. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.(for occupant notification applications)
- 15. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A. .(for occupant notification applications)

Each module shall identify and report ground faults, opens and shorts associated with its supervised input / output circuits, by device address, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

The Universal Class A/B Module shall an Edwards SIGA-UM.

2.5.2. NOTIFICATION APPLIANCES

2.5.2.1. LOW PROFILE

2.5.2.1.1. STROBES

Provide low profile wall mounted strobes at the locations shown on the drawings.

Low profile strobes shall mount in a North American 1-gang box, and protrude less than 1" from the finished wall. The word FIRE shall be prominently displayed on the housing.

The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the strobe is in its installed position. Amber lens strobes shall be available with outputs of 12/24/60/88cd. Light shall be evenly distributed throughout the required volume using cavity and mask "FullLight" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.

When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The strobes shall be Edwards Genesis G1 Series.

2.5.2.1.2. STROBES-WEATHERPROOF

Provide low profile weatherproof strobes at the locations shown on the drawings.

The weatherproof strobes shall mount in a North American 4" square 1 1/2" deep electrical box for indoor applications and a factory supplied back box for weatherproof applications.

The strobe shall be suitable for wall or ceiling mount and operate in temperatures from -40 to 151 degrees F. The word FIRE shall be prominently displayed on the housing.

The strobe output shall be switch selectable as required by its application from the following available settings:

		Standard Candela Output Strobes				High Candela Output Strobes			
		Strobe Switch Position							
Listing	Location	D	C	B	A	D	C	B	A
UL 1971	Indoor	15 cd	29 cd	70 cd	87 cd	102 cd	123 cd	147 cd	161 cd
UL 1638	Outdoor (-35C)	6 cd	12 cd	28 cd	35 cd	41 cd	50 cd	60 cd	65 cd

Selected strobe rating shall be visible when the speaker-strobe is in its installed position

When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of

wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The weatherproof strobes shall be Edwards Genesis WG4 Series.

2.5.2.1.3. SPEAKER-WALL

Provide low profile wall mounted speakers at the locations shown on the drawings.

The low profile speakers shall mount in a North American 4" x 2 1/8" square electrical box, and protrude less than 1" from the finished wall. The word FIRE shall be prominently displayed on the housing.

The speaker output shall be switch selectable from the following available settings: 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker is in its installed position.

The speaker shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The low profile wall mounted speakers shall be an Edwards Genesis G4 series.

2.5.2.1.4. SPEAKER-CEILING

Provide low profile ceiling mounted speaker at the locations shown on the drawings.

Speakers shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling. The word FIRE <ALERT> shall be prominently displayed on the housing.

The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.

The speaker shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The low profile ceiling mounted speaker shall be an Edwards Genesis GC series.

2.5.2.1.5. SPEAKER-WEATHERPROOF

Provide low profile weatherproof speakers at the locations shown on the drawings.

The weatherproof speaker shall mount in a North American 4" square 1 1/2" deep electrical box for indoor applications without a trim skirt and a 4" square 2 1/8" deep electrical box when used with a trim skirt. A factory supplied back box shall be supplied for weatherproof applications.

The speaker shall be suitable for wall or ceiling mount and operate in temperatures from -40 to 151 degrees F. The word FIRE shall be prominently displayed on the housing.

The speaker output shall be switch selectable from the following available settings:

Wattage	Switch Position	25Vrms	70Vrms
2W	T	90.0 dBA	89.7 dBA
1W	X	87.1 dBA	86.9 dBA
1/2 W	Y	84.0 dBA	83.9 dBA
1/4 W	Z	80.8 dBA	80.8 dBA

Output is at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.

The speaker shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The weatherproof speaker shall be Edwards Genesis WG4 Series.

2.5.2.1.6. SPEAKER-STROBE-WALL

Provide low profile wall mounted speaker-strobes at the locations shown on the drawings.

The low profile speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings, and protrude less than 1" from the finished wall. The word FIRE shall be prominently displayed on the housing.

The speaker output shall be switch selectable from the following available settings: 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.

The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position. Amber lens strobes shall be available with outputs of 12/24/60/88cd. Light shall be evenly distributed throughout the required volume using cavity and mask "Full Light" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.

When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules

Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The low profile wall mounted speaker-strobes shall be an Edwards G4 series.

2.5.2.1.7. SPEAKER-STROBE-CEILING

Provide low profile ceiling mounted speaker-strobes at the locations shown on the drawings.

Speaker-strobes shall mount in a North American 4" x 2 1/8" square electrical box, or a 960A-4RF round flush box, and protrude less than 1.6" from the finished ceiling. The word FIRE shall be prominently displayed on the housing.

The speaker output shall be switch selectable from the following available settings: 2W (91dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (80dBA) at 10 ft. when measured in reverberation room per UL-1480. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.

The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 95cd or 95cd, 115cd, 150cd, &177cd. Selected strobe rating shall be visible when the speaker-strobe is in its installed position. Amber lens strobes shall be available with outputs of 13/26/65/82cd or 82/100/130/155cd.

When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules

Strobe power and synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The low profile ceiling mounted speaker-strobes shall be an Edwards Genesis GC series.

2.5.2.1.8. SPEAKER-STROBE-WEATHERPROOF

Provide low profile weatherproof speaker-strobes at the locations shown on the drawings.

The weatherproof speaker-strobes shall mount in a North American 4" square 1 1/2" deep electrical box for indoor applications without a trim skirt and a and a 4" square 2 1/8" deep electrical box when used with a trim skirt. A factory supplied back box shall be supplied for weatherproof applications.

The speaker-strobe shall be suitable for wall or ceiling mount and operate in temperatures from -40 to 151 degrees F. The word FIRE shall be prominently displayed on the housing.

The speaker output shall be switch selectable from the following available settings:

Wattage	Switch Position	25Vrms	70Vrms
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2W	T	90.0 dBA	89.7 dBA
1W	X	87.1 dBA	86.9 dBA
½ W	Y	84.0 dBA	83.9 dBA
¼ W	Z	80.8 dBA	80.8 dBA

Output is at 10 ft. when measured in reverberation room per UL-464. Frequency response shall be 400 to 4,000Hz. The selected speaker wattage shall be visible when the speaker-strobe is in its installed position.

The strobe output shall be switch selectable as required by its application from the following available settings:

		Standard Candela Output Speaker-Strobes				High Candela Output Speaker-Strobes			
		Strobe Switch Position							
Listing	Location	D	C	B	A	D	C	B	A
UL 1971	Indoor, Clear lens	15 cd	29 cd	70 cd	87 cd	102 cd	123 cd	147 cd	161 cd
UL 1971	Indoor, Amber lens	13 cd	25 cd	59 cd	62 cd	84 cd	101 cd	125 cd	130 cd
UL 1638	Outdoor, Clear lens	6 cd	12 cd	28 cd	35 cd	41 cd	50 cd	60 cd	65 cd
UL 1638	Outdoor, Amber lens	5 cd	10 cd	24 cd	25 cd	34 cd	41 cd	51 cd	52 cd

Selected strobe rating shall be visible when the speaker-strobe is in its installed position

When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. Both the speaker and strobe elements shall provide in and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

The weatherproof speaker-strobes shall be Edwards Genesis WG4 Series.

2.5.2.1.11. SPEAKER-STROBE RE-ENTRANT

Provide 4" red re-entrant speaker-strobes at the locations shown on the drawings. Weatherproof boxes shall be provided for outdoor mounting. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 25V or 70V systems. The re-entrant speakers shall utilize a high efficiency compression drivers. Cone type drivers are not acceptable. At the 15 watt setting, the speaker shall provide a 102 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, & 110cd devices.

The re-entrant speaker-strobes shall be Edwards 757 series.

2.5.3. TELEPHONES

2.5.3.1. TELEPHONE JACK STATIONS

Provide stainless steel 4-state firefighter’s telephone jack stations at the locations shown on the drawings.

The jack station shall be clearly identified with the words "FIRE FIGHTER’S TELEPHONE" for use with portable fire fighter telephone handsets.

Plugging in a remote handset into the jack station shall signal the main fire alarm panel of an incoming phone call.

The firefighter’s telephone jack stations shall be Edwards 6833-4.

2.5.3.2. TELEPHONE HANDSETS

Provide five (5) 4-state firefighter’s telephone handsets with push-to-talk-type controls for use with the firefighter’s telephone jack stations. The telephone handsets shall be red in color and have a 5 foot (1.3m) coiled cord.

The firefighter’s telephone handsets shall be Edwards 6830 series.

2.5.3.3. TELEPHONE STORAGE CABINET

Provide a firefighters' telephone storage cabinet at the location shown on the drawings.

The cabinet shall have the capacity to hold six (6) phones and a red finish with white lettering "Emergency telephone." A locked door shall be provided,

The Firefighters' telephone storage cabinet shall an Edwards TCS-6.

2.5.4. ACCESSORIES

2.5.4.1. MAGNETIC DOOR HOLDERS

Provide wall mounted fail safe electromagnetic door holders as shown on the drawings.

Holders shall provide approximately 25-lbf nominal holding force when energized. The units shall have an aluminized finish and contain no moving parts. The contact plate shall have an integral nylon swivel to absorb shock and adjust to any door angle.

Flush and semi-flush models shall be designed for concealed wiring applications and shall mount on standard 1-gang electrical box. Floor mounted electromagnet units shall consist of a floor plate, gaskets, and housing. Incoming conduit shall connect directly into floor plate. The housing and gaskets shall mount on the floor plate to form a weatherproof junction box Door holders shall be listed to UL-228.

All holders shall be normally be energized, and a release shall be accomplished by interrupting the circuit.

The electromagnetic door holders shall be Edwards 1500 series.

2.5.4.2. INSPECTION BAR CODES

- A. Inspection bar codes shall be installed on all initiating devices, addressable modules, annunciators, control panels and power supplies.
- B. Inspection bar codes used by the system must utilize Code 3 of 9 or other approved format, and contain a minimum of eight (8) digits that comprise a unique serial identifier within the Web-based Reporting System. There shall be no duplication of device ID numbers. The ID number shall be printed below the bar code for identification purposes.
- C. Inspection bar codes shall be limited in size to no more than 2" (5cm) in width, and 3/8" (2 cm), in height and shall include a Mylar[®] or other protective coating to protect the bar code from fading due to sunlight or exposure.
- D. Inspection bar codes shall be installed on each device in such a manner as to require that scanning of the bar code take place no further than 12" from the device during inspection.

3. PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. GENERAL

General

- A. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams.
- B. All work shall be performed in accordance with the requirements of NFPA 70 and NFPA 72.
- C. Coordinate locations of all devices with all other divisions' drawings and specifications.

- D. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the contract drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer.
- E. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
- F. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- G. No wiring except life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures.
- H. Any low-voltage copper wiring that leaves the protection of a building shall be provided with a compatible UL 497B listed transient protection devices where the circuit leaves the building and where it enters the next building.
- I. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled such that removal of the device is not required to identify the EOL device.
- J. Fiber Optic Cable
 - 1. Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.
 - 2. ST connectors shall be used at all equipment terminations.
- K. Concrete floors shall be X-rayed prior to core drilling on post tension slabs. Verify with engineer on type of slab prior to bid.

3.1.2. ELECTRICAL

Electrical

1.01 BOXES, ENCLOSURES AND WIRING DEVICES

- A. Boxes shall be installed plumb and firmly in position.
- B. Extension rings with blank covers shall be installed on junction boxes where required.
- C. Junction boxes served by concealed conduit shall be flush mounted.
- D. Fire alarm system junction box covers shall be painted red.
- E. Wiring within cabinets, enclosures, boxes, junction boxes and fittings shall be installed in a neat and workmanlike manner, installed parallel with or at right angles to the sides and back of any box, enclosure or cabinet, and routed to allow access for maintenance. All conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with approved pressure type terminal blocks, which are securely mounted. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. No more than two conductors shall be installed under one connection. Wire nuts, crimp splices and similar devices shall not be used.

1.02 CONDUCTORS

- A. Each conductor shall be identified as shown on the drawings at terminal points. Permanent wire markers shall be located within 2 inches of the wire termination. Marker text shall be visible with protective doors or covers removed.
- B. Maintain a consistent color code for fire alarm system conductor functions throughout the installation.

- C. All wiring shall be installed in compliance with the National Electric Code, NFPA 70, and the equipment manufacturer's requirements.

Wiring for Signaling Line Circuit and Initiating Device Circuit field wiring shall be solid copper, No. 18 AWG twisted pair conductors at a minimum. Speaker circuits; 16 AWG twisted pair at a minimum. Telephone circuits shall be 18 AWG twisted-shielded pair at a minimum. 24VDC visual and audible Notification Appliance Circuits shall be solid copper No. 14 AWG size conductors at a minimum. The wiring sizes listed herein are minimum sizes. Use larger wire sizes when recommended by the manufacturer, based on system configuration and project specific calculations.

Where shielded wiring is used, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP or other control equipment. Shields shall be continuous, treated as a third conductor, and insulated from ground except as noted.

T-taps (branches) are permitted in Style 4 SLC circuits with interconnections occurring on terminal strips.

Circuits to third-party systems (HVAC, Elevators, fire pumps, etc.) shall terminate in terminal cabinets within three (3) feet of the controllers for those systems.

AC power wiring shall be No. 12 AWG solid copper having insulation rated for 600 volts.

Crimp type spade lugs shall be used for terminations of stranded conductors to binder screws or stud type terminals.

- D. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.

1.03 DEVICES

- A. All devices and appliances shall be mounted to or in an approved electrical box.

1.04 Raceways

- A. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
- B. Install all conductors in rigid metal conduit or electro-metallic tubing, utilizing compression type fittings and couplings, with a minimum diameter 3/4". The use of flexible metal conduit not exceeding a six (6) foot length shall be permitted for initiating device circuits.
- C. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or fire damage, and shall not to interfere with existing building systems, facilities or equipment.
- D. Run conduit or tubing concealed in finished areas unless specifically shown otherwise on the drawings. Conduit may be exposed in unfinished mechanical/electrical rooms, and basement levels.
- E. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back box locations shall be readily accessible for inspection, testing, service and maintenance.

1.05 OPEN CABLE

- A. Power Limited cable, when not installed in UL listed metal conduit or raceway, shall be mechanically protected by building construction features per NFPA 70, Article 760.
 - 1. Installation shall be in areas not subjected to mechanical injury.
 - 2. All circuits shall be supported by the building structure. Cable shall be attached by straps or bridal rings to the building structure at intervals not greater than 10 feet. The use of staples is prohibited. Fire alarm wiring shall not be bundled or strapped to existing conduit, pipe or wire in the facility.
 - 3. Where wiring is installed above drop ceilings, cable shall not be laid on ceiling tiles.
 - 4. Cable shall not be fastened in a manner that puts tension on the cable.
- B. Power Limited Cable shall be FPLP, FPLR or FPL, or permitted substitute.

3.1.3. FA COMPONENTS

FA Components

SECTION 283100

INTEGRATED LIFE SAFETY SYSTEM

Page 38 of 40

1.01 DEVICES

1. All devices and appliances shall be mounted to or in an approved electrical box.
2. All wall mounted *control equipment* shall comply with requirements defined by the International Building Code and Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems (AC-156) using a seismic component importance factor of 1.5.
 - A. Fire Alarm Control Panels
 - a. Mount the enclosure with the top of the cabinet 72" above the finished floor or center the cabinet at 63", whichever is lower.
 - b. Label the fire alarm panels with the room number, electrical panel number and circuit breaker number feeding them.
 - c. Paint the handles of the dedicated circuit breakers feeding fire alarm panels red, and install handle locks.
 - d. Within the panel, all non-power limited wiring must be properly separated from power limited circuits.
 - e. Grounds shall comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
 - B. Remote Annunciator
 - a. Mount the panel; with the top of the panel 72" above the finished floor or center the panel at 63", whichever is lower.
 - C. Remote power supplies and auxiliary fire alarm panels
 - a. Locate the panel or cabinet with the top of the panel 72" above the finished floor or center the panel at 63", whichever is lower.
 - b. Do not locate these panels above ceilings or where inaccessible by a person standing on the finished floor of the space.
 - c. Label the power supplies and auxiliary FACP's with the room number, electrical panel number and circuit breaker number feeding them.
 - d. Paint the handles of the dedicated circuit breakers feeding fire alarm panels red, and install handle locks.
 - e. Within the panel, all non-power limited wiring must be properly separated from power limited circuits.
 - D. Manual Pull Stations
 - a. Mount stations so that their operating handles are between 42" and 48" above the finished floor.
 - E. Firefighter Telephone Jacks
 - a. Wall mount at 48" above the finished floor.
 - F. Notification Appliances: Mount assemblies as follows:
 - a. All wall mounted audio/visual devices shall be mounted so the entire lens is between 80" and 96" above the finished floor. Where low ceilings exist, devices shall be mounted within 6" of the ceiling.
 - b. Each speaker's (horn) output shall be set to the wattage value indicated for its specific location as shown on the drawings.
 - c. Each strobe's output shall be set to the candela value indicated for its specific location as shown on the drawings.
 - d. Each speaker (horn)-strobe's outputs shall be set to the wattage/candela value indicated for its specific location as shown on the drawings.
 - e. Where ceiling height exceeds 30 feet, appliances shall be suspended from the ceiling to a height of 30 feet maximum above the finished floor.
 - f. Appliances installed outdoors shall be UL listed for outdoor use.
 - G. Smoke Detectors:
 - b. Smoke and heat detector heads shall not be installed until after construction clean-up is completed. Detector heads installed prior to construction clean-up shall be cleaned by the manufacturer or replaced.
 - c. Detectors located on the wall shall have the top of the detector at least 4" and not more than 12" below the ceiling.
 - d. On smooth ceilings, detectors shall not be installed over 30 ft. apart in any direction.
 - e. Install smoke detectors no closer than 3 ft. from air handling supply air diffusers or return air openings.
 - f. Locate detectors no closer than 12" from any part of a lighting fixture.
 - H. Duct Smoke Detectors:
 - a. Install sampling tubes so they extend the full width of ducts exceeding 36".
 - b. Detectors shall be located to facilitate ease of maintenance.

- c. All penetrations near detectors located on/in return ducts shall be sealed to prevent air entry.
- I. Air Aspirating Smoke Detectors
 - a. All air sampling pipes and sampling points shall be airtight and permanently fixed.
 - b. All air sampling piping shall be identified as "SMOKE DETECTOR SAMPLING TUBE - DO NOT DISTURB" at changes in direction or pipe branches, penetrations of walls, floors or other barriers, at intervals no greater than 20'.
 - c. Air sampling points drilled in piping shall be prominently identified.>
- J. End-of-Line Resistors
 - a. Devices containing end-of-line resistors shall be appropriately labeled.
- K. Remote Status and Alarm Indicators:
 - a. Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- L. Single-Station Smoke Alarms:
 - a. Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- M. CO Detectors
 - a. Ceiling mounted CO detectors should be kept 12" from sidewalls.
 - b. Wall mounted CO detectors should be at least 48" above the finished floor, but less than 6" from the ceiling.
 - c. Locate at least 60" from fuel burning appliances.
 - d. Install CO detectors no closer than 3 ft. from air handling supply air diffusers or return air openings.
- N. Beam Smoke Detectors
 - a. Install beam type smoke detectors in accordance with the shop drawings and the manufacturer's recommendations.
 - b. Mount detectors 19" to 24" below the ceiling unless instructed otherwise.
 - c. Keep the centerline of the beam 19" from obstructions.
 - d. Mount on solid surfaces (brick/block walls, steel beams, or concrete).
 - e. Use all mounting points on detector mounts.
 - f. Mount where accessible for maintenance.
- O. Heat Detectors
 - a. Heat detectors shall be installed in strict accordance with their UL listing and the requirements of NFPA 72.
 - b. Heat detectors installed in the elevator machinery room to meet ANSI A17.1 requirements for elevator power disconnect, shall be located adjacent to each sprinkler head. Coordinate temperature rating and location with sprinkler rating and location.
- M. Addressable Control (relay) Modules
 - a. Install the module less than 3 feet from the device controlled.
 - b. Orient the device mounting for best maintenance access.
 - c. Label all addressable control modules as to their function.
 - d. Provide a dedicated 24VDC circuit to feed all auxiliary relays required for inductive loads (auxiliary relays, door holders). Circuits shall be supervised via an end-of-line relay and addressable input module. Auxiliary relays shall not derive their power from the starter or load being controlled.

END OF SECTION

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